UNITED STATES DEPARTMENT OF AGRICULTURE

AGRICULTURAL RESEARCH SERVICE

E X P L A N A T O R Y N O T E S

Fiscal Year

1977

AGRICULTURAL RESEARCH SERVICE

Purpose Statement

The Agricultural Research Service (ARS) was established on November 2, 1953, pursuant to authority vested in the Secretary of Agriculture by 5 U.S.C. 301 and Reorganization Plan No. 2 of 1953, and other authorities.

The Agency is responsible for conducting basic, applied, and developmental research of:

-- Animal production
-- Plant production
-- Use and improvement of soil, water, and air
-- Marketing, use, and effects of agricultural products

The research applies to a wide range of goals; commodities; natural resources; fields of science; and geographic, climatic, and environmental conditions. It is categorized into 67 ARS National Research Programs and eight Special Research Programs.

The mission of ARS research is to develop new knowledge and technology which will insure an abundance of high quality agricultural commodities and products at reasonable prices to meet the increasing needs of an expanding economy and to provide for the continued improvement in the standard of living of all Americans. This mission focuses on the development of technical information and technical products which bear directly on the needs to (1) manage and use the Nation's soil, water, air, and climate resources and improve the Nation's environment; (2) provide an adequate supply of agricultural products by practices that will maintain a permanent and effective agriculture; (3) improve the nutrition and well-being of the American people; (4) improve living and rural America; (5) strengthen the Nation's balance of payments; and (6) promote world peace.

In addition to the regular research program, the Service directs foreign research mutually beneficial to the United States and the host country which can be advantageously conducted in foreign countries. Under this program agreements are made with individual foreign research institutions and universities. The program is carried out under the authority of Section 104(b)(1) and (3) of Public Law 480, the Agricultural Trade Development and Assistance Act of 1954, as amended.

The Agency's research is conducted at numerous field locations in the States, District of Columbia, Puerto Rico, the Virgin Islands, and in several foreign countries. Much of the work is conducted in direct cooperation with the State agricultural experiment stations, or other State and Federal agencies, and with private organizations.

Central offices for the Administrator of ARS and his staff are maintained in the Washington, D.C. Metropolitan Area, which provide overall leadership and direction to the programs and activities assigned to the Agricultural Research Service. The field activities are managed on a geographical basis through four Regional Offices, 20 Area Offices and seven major Research Centers.

Available Funds and Man-Years
1975 and Estimated, 1976 and 1977

Item	Actual 1975		Estimated 1976		Estimated 1977	
	Amount	Man-Years	Amount	Man-Years	Amount	Man-Years
Agricultural Research Service:	a/		a/		a/	
Regular appropriation:	$208,450,000)		$262,304,000)		$263,202,000)	
Transfer from	)	9,054	)	9,474	)	9,474
Section 32 funds ..	15,000,000)		- -)		- -)	
Scientific activities overseas (Special Foreign Currency Program)	5,000,000	14	7,500,000	15	10,000,000	15
Total	228,450,000	9,068	269,804,000	9,489	273,202,000	9,489
Deduct allotments to other agencies	-604,056	-24	-1,221,000	-28	-1,375,000	-28
Net	227,845,944	9,044	268,583,000	9,461	271,827,000	9,461
Obligations under other USDA appropriations:						
Animal and Plant Health Inspection Service--emergency programs and field station services .	3,293,774	102	3,730,825	111	3,730,825	111
Food and Nutrition Service--improved dietary nutrition	246,356	15	305,736	16	305,736	16
National Agricultural Library--various services .	286,469	- -	335,784	- -	335,784	- -
Soil Conservation Service--field station services .	257,624	- -	64,307	- -	64,307	- -
Economic Research Service--including P.A.S.A. and training of foreign nationals ...	717,305	21	1,235,688	26	1,235,688	26
Agricultural Marketing Service--field station services .	93,495	- -	128,493	- -	128,493	- -
Coordinated Departmental Services ..	32,522	1	27,257	1	27,257	1
Miscellaneous reimbursements ...	1,595	- -	1,587	- -	1,587	- -
Total Other USDA Appropriations .	4,929,140	139	5,829,677	154	5,829,677	154
Total, Agricultural Appropriation	232,775,084	9,183	274,412,677	9,615	277,656,677	9,615
Working Capital Fund	4,942	- -	- -	- -	- -	- -
Other Federal funds .	6,390,448	122	9,326,251	111	9,327,251	111
Non-Federal funds ...	948,480	27	1,007,272	28	1,010,272	28
Total, Agricultural Research Service ...	240,118,954	9,332	284,746,200	9,754	287,994,200	9,754

	1975 Actual	1976 Estimated	1977 Estimated
End-of-Year Employment:			
Permanent full-time	8,174	8,331	8,331
Other	1,350	1,500	1,470
Total included in ceiling	9,524	9,831	9,801
Number of disadvantaged youth	448	600	600
Total	9,972	10,431	10,401

a/ Excludes $1,000,000 reappropriation.

(a) Agricultural Research Service

Appropriation Act, 1976		$255,675,000 a/
Budget Estimates, 1977		263,202,000
Increase in appropriation		+7,527,000
Adjustments in 1976:		
Appropriation Act, 1976	$255,675,000	
Supplemental Appropriation for pay costs	+6,629,000	
Adjusted base for 1977		262,304,000
Budget Estimate, 1977		263,202,000
Increase over adjusted 1976		$ +$898,000

a/ Excludes reappropriation of $1,000,000 of prior year funds for additional labor, subprofessional and junior scientific help in the field.

SUMMARY OF INCREASES AND DECREASES
(on basis of adjusted appropriation)

	1976	Increase or Decrease	1977 Estimate
Program Changes:			
Improve yields and quality of crops through increased research on nitrogen fixation, photosynthesis, and cell biology	$ 1,409,000	$+1,199,000 (1)	$2,608,000
Increase yield and quality of food and feed grains, oilseeds, cotton, fruits, vegetables and ornamentals, including technologies to meet climatic variables	5,808,000	+1,873,000 (2)	7,681,000
Protection against genetic vulnerability of crops	2,410,000	+656,000 (3)	3,066,000
Develop safe and effective pest control technology for horticultural and field crops with emphasis on special uses	4,293,000	+1,334,000 (4)	5,627,000
Increase supplies of high quality animal protein through research on production and disease and insect prevention and control	13,693,000	+1,876,000 (5)	15,569,000
Improve and conserve soil, water, and air resources for expanding agricultural production and environmental protection	16,632,000	+1,114,000 (6)	17,746,000

	1976	Increase or Decrease		1977 Estimate
Program Changes: cont'd.				
Improve production, use and quality of forages and grazing lands to support efficient meat and milk production	$1,974,000	+436,000	(7)	2,410,000
Improve human nutrition and food safety, and determine nutrient availability in foods	1,336,000	+750,000	(8)	2,086,000
Tropical and subtropical agricultural research and training	529,000	+140,000	(9)	669,000
Research to support Animal and Plant Health Inspection Service trial program on eradication and control of bollweevil	3,368,000	+500,000	(10)	3,868,000
Repair and maintenance of facilities	---	+1,656,000	(11)	1,656,000
Annualization of pay increases effective in FY 1976.....	6,629,000	+2,955,000	(12)	9,584,000
Payment to GSA for rental of government-owned or leased space	1,758,000	+304,000	(13)	2,062,000
Dairy herd improvement	1,500,000	-1,500,000	(14)	---
Marketing research	52,046,000	-2,000,000	(15)	50,046,000
All Other	138,524,000	---		138,524,000
Total, Program Changes ..	251,909,000	+11,293,000		263,202,000
Facility Changes:				
Elimination of non-recurring facility items	10,395,000 a/	-10,395,000	(16)	---
Total, Available	262,304,000	+898,000		263,202,000

a/ Excludes proposed supplementals of $6,000,000 for Plum Island, N.Y. construction and $2,350,000 for Beltsville, Md. construction; proposed rescission of $225,000 for construction planning at Grand Forks, North Dakota.

PROJECT STATEMENT
(on basis of adjusted appropriation)

	1975	1976 (Estimated)	Increase or Decrease	1977 (Estimated)
1. Research on animal Production:				
(a) Animal production efficiency research	$ 42,389,535	$50,248,000	+1,562,000	$51,810,000

	1975	1976 (Estimated)	Increase or Decrease	1977 (Estimated)
2. Research on plant production:				
(a) Crop production efficiency research	78,990,019	93,104,000	+6,610,000	99,714,000
(b) Tropical and subtropical agricultural research	512,652	529,000	+147,000	676,000
Total, Research on Plant production	79,502,671	93,633,000	+6,757,000	100,390,000
3. Research on the use and improvement of soil, water, and air:				
(a) Research on conservation and use of land and water resources and maintaining environmental quality	18,723,858	21,851,000	+2,048,000	23,899,000
(b) Research on watershed development	7,742,141	9,313,000	+676,000	9,989,000
Total, Research on the use and improvement of soil, water, and air	26,465,999	31,164,000	+2,724,000	33,888,000
4. Research on marketing, use and effects of agricultural products:				
(a) Marketing efficiency research	47,458,225	52,046,000	-967,000	51,079,000
(b) Research to expand agricultural exports	1,821,048	1,948,000	+38,000	1,986,000
(c) Food and nutrition research	7,862,636	11,036,000	+530,000	11,566,000
(d) Research to improve human health and safety	10,369,715	10,803,000	+628,000	11,431,000
(e) Research on consumer services	443,280	592,000	+14,000	606,000
(f) Research on housing	224,720	304,000	+5,000	309,000
Total, Research on marketing use and effects of agricultural products	68,179,624	76,729,000	+248,000	76,977,000
5. Support services for other USDA Agencies	127,000	135,000	+2,000	137,000
6. Construction of facilities	6,420,000	a/ 10,395,000	-10,395,000	---
7. Contingency research fund	b/	1,000,000	---	1,000,000
Unobligated balance	1,365,171	---	---	---
Subtotal	224,450,000	263,304,000	+898,000	264,202,000
Deduct reappropriation for Special Fund	-1,000,000	-1,000,000	---	-1,000,000
Total available or estimate	223,450,000	262,304,000	+898,000	263,202,000
Transfer from Departmental Administration for support services to other USDA agencies	-127,000	- -		
Supplemental Appropriation for pay costs	- -	-6,629,000		
Total appropriation	223,323,000	255,675,000		

a/ Excludes proposed supplementals of $6,000,000 for Plum Island, N.Y. construction and $2,350,000 for Beltsville, Md. construction; proposed rescission of $225,000 for construction planning at Grand Forks, N.D.

b/ Obligations $959,306 of the $1,000,000 appropriated in 1975 are included in the projects above.

EXPLANATION OF PROGRAM

Under the Agriculture and Related Agencies Appropriation Act of 1976, the Agricultural Research Service carries out the following activities:

1. Research on animal production.--Research is conducted to improve livestock productivity (including poultry) through improved breeding, feeding, and management practices and to develop methods for controlling diseases, parasites, and insect pests affecting them.

2. Research on plant production.--Research is conducted to improve plant productivity (including ornamentals, trees, turf, tropical and subtropical crops) through improved varieties of food, feed, fiber, and other plants; develop new crop resources; and improve crop production practices, including methods to control plant disease, nematodes, insects, and weeds.

Plant and Animal Production Efficiency Research is authorized by the Department of Agriculture Organic Act of 1862 (5 U.S.C. 511) and the Research and Marketing Act of 1946, as amended (7 U.S.C. 427, 427i). These laws authorize the acquiring and diffusing of information on agriculture and the research on production of agricultural commodities and matters related to agriculture. Other laws covering specific research are: Foot-and-Mouth Disease Research, Public Law 80-496, April 24, 1948, (21 U.S.C. 113a); Cattle Grub Research, P.L. 80-651, June 16, 1948, (21 U.S.C. 114e, f); Agricultural Engineering Research, P.L. 81-171, June 25, 1949, (42 U.S.C. 147a); Agricultural Programs in the Virgin Islands, P.L. 82-228, October 29, 1951, (48 U.S.C. 1409 m, n, o); Cooperation of States in USDA Programs, P.L. 87-718, September 28, 1962, (7 U.S.C. 450); Payment of Indirect Costs of Research, P.L. 87-638, September 5, 1962; (no code citation); Cooperative Research Projects, P.L. 88-250, December 20, 1963, (7 U.S.C. 450a);Public Law 69-799, March 4, 1927 (20 U.S.C. 191-194) which authorized the establishment and operation of the National Arboretum in Washington, D.C., and under the Food for Peace Act, Title IV, Section 406(4), p. 12, the Secretary of Agriculture is authorized to conduct research in tropical and subtropical agriculture.

3. Research on the use and improvement of soil, water, and air.--Research is conducted to improve the management of natural resources, including investigations to improve soil and water management, irrigation, and conservation practices, and to determine the relation of soil types and water to plant, animal, and human nutrition. The research includes studies on hydrologic problems of agricultural watershed and the application of remote sensing techniques in meeting agricultural problems. Research is also conducted on agricultural pollution problems such as protection of plants, animals, and natural resources from harmful effects of soil, water, and air pollutants, and ways to minimize and utilize industry processing wastes of agricultural commodities.

This research is authorized by the Department of Agriculture Organic Act of 1862 (5 U.S.C. 511) and the Research and Marketing Act of 1946, as amended (7 U.S.C. 427, 427i). Other laws covering specific research are under Sections 1-6 of the Soil Conservation and Domestic Allotment Act (16 U.S.C. 590 a-f), and under Section 76 of the Strategic and Critical Materials Stock Piling Act (50 U.S.C. 980). Public Law Number 88-379, July 14, 1964, covers the Water Resources Research Act (7 U.S.C. 301-308). Public Law 92-500, October 18, 1972, covers the Water Pollution and Control Act. Statutory authority affecting this and related pollution research programs includes the National Environmental Policy Acts of 1969 and 1970 (Public Laws 91-190 and 91-224), and such predecessors as the Water Pollution Control Acts (P.L.'s 84-660, 87-88, etc.), the Water Quality Act (P.L. 89-234), and the Clean Water Restoration Act of 1966 (P.L. 89-753). For further reference, see Secretary Hardin's Memorandum No. 1695, 33

U.S.C. 466 and seq., Section 2, P.L. 89-234. In addition, there is the Water Quality Improvement Act of 1970 (P.L. 91-224), the Air Quality Act (P.L. 90-148, S. 780, and Section 2, as amended in 42 U.S.C. 1857-18571), the Resource Recovery Act of 1970 (42 U.S.C.A., S. 3251 et seq.), the Refuse Act (33 U.S.C., Sections 407, 407a, 411), the Rural Development Act of 1972 (P.L. 92-419, and the Federal Water Pollution Control Act of 1972 (P.L. 92-500).

4. Research on marketing, use and effects of agricultural products.--Research is conducted to develop new and improved foods, feeds, fabrics, and industrial products and processes for agricultural commodities for domestic and foreign markets. Research is conducted on marketing of agricultural products. Studies concern the processing, transportation, storage, wholesaling and retailing of products, to reduce the costs of marketing, to maintain product quality, and to reduce losses from waste and spoilage.

Research is conducted on human nutritional requirements, composition, and nutritive value of food needed for consumers and for Federal, State, and local agencies administering food and nutrition programs.

Research is conducted on problems of human health and safety. Studies concern developing means to insure food supplies and products free from toxic or potentially dangerous residues from agricultural sources and processing operations, harmful chemicals, micro-organisms, and from naturally occuring toxins. The research conducted also includes studies concerning means to control insect pests of man and his belongings; prevent transmission of animal disease and parasites to man; reduce the hazards to human life resulting from pesticide residues, toxic molds, tobacco, and other causes; and, develop technology for the detection and destruction of illicit growth of narcotic-producing plants.

Research is conducted on consumer services to measure family use of resources, to identify economic problems of families; and to provide information on fabric performance and the use and care of clothing and household articles by consumers.

Research on housing is conducted to provide knowledge and technology to help bring about improved designs, material, and construction methods for both low-cost renovation and new construction of rural housing suitable for low-to-moderate-income rural residents.

This research is authorized by the Department of Agriculture Organic Act of 1862 (5 U.S.C. 511); Agricultural Adjustment Act of 1938 (P.L. 75-430), February 16, 1938; the Research and Marketing Act of 1946, as amended (7 U.S.C. 427, 427i), and Title 7, U.S.C., Agriculture, Chapters 17, 35, 38, and 55; The Agricultural Trade Development and Assistance Act of 1954 (7 U.S.C. 1691); Public Law 81-171, Agricultural Engineering Research (42 U.S.C. 1476); The Occupational Safety and Health Act of 1970 (P.L. 91-596) declared it to be the purpose and policy of the Congress to assure safe and healthful working conditions and to preserve our human resource, by (such means as) providing for research in the field of occupational safety and health, and by developing innovative methods, techniques, and approaches for dealing with the problems (Sec. 2). Standards, tolerances and regulations promulgated by USDA and other Federal departments under various statutes and dealing with food and natural fiber products, food additives, residues, and contaminants also support the USDA mission of consumer services and human resource development.

JUSTIFICATION OF INCREASES AND DECREASES

ARS is proposing a budget request for FY 1977 that represents a decrease of $7.2 million. This total includes $14.8 million for increased program requirements, $3.5 million for program decreases and a decrease of $18.5 million to eliminate non-recurring facility construction costs. The amount requested is consistent with the need for a responsible fiscal policy for FY 1977. Funding is requested only for those projects offering the greatest contributions to finding solutions to problems of higher priority in the USDA and in the national interest.

The list of high priority research needs was developed through an extensive review and evaluation process. The process limited new proposals to those which are most urgent and generally those which have a high probability of success over a reasonable time frame. New proposals were also limited to those areas where state and private institutions would be unlikely to undertake the same or similar research.

Federally financed research should provide for new technologies to increase productivity and decrease commodity costs. A large range of newly emerging urgent problems require technological answers. Such answers will help alleviate the severe demands currently placed on our food and fiber industry.

Several factors limit the effort of private research organizations to keep pace with changing technological requirements. As technology becomes more complex, it is becoming more expensive to discover and develop. Also private institutions often have difficulty recouping the costs of research that has large public benefits.

The reservoir of unused information has largely diminished as farmers have accelerated their rate of adoption of available new technology. ARS resources have to meet short-range urgent problems as well as long-term problems. Funding for research in new areas of photosynthesis efficiency and nutrient composition of foods was requested in FY 1976 and research initiated in these areas needs increased funding levels in order to achieve its long-run potential.

An evaluation of research results is made throughout the year to determine progress being made and redirect resources as appropriate. The ARS program was assessed throughout FY 1975 to improve its effectiveness and efficiency, and significant program redirections were made. Redirection plans were devised as a result of program reviews, workshops, and meetings with other agencies, universities, and private institutions.

This 1977 budget request has been designed to respond as quickly as possible to new and serious demands that have been placed on the U.S. food and fiber industries. There is increasing concern over the likelihood that the rate of flow of new technology production over recent years cannot be sustained. This concern is based on the: (1) general slippage in scientific capacity in the past 10 years due to inflationary costs, (2) higher average constant dollar costs in undertaking ncreasingly complex problems, (3) increasing demands to maintain and improve the environment, (4) increasing demands for safe and nutritionally acceptable foods, (5) increasing pressures placed on high yielding plants and animals by the environment, insect pests, and diseases, (6) new technology demands caused by high energy prices, use of marginal lands, consumers demands, and inability to use certain existing technology, (7) persistent and formidable yield barriers, and (8) erosion of technology reserves.

The proposed budget request will help expand food and fiber production and minimize agricultural commodity costs. The priority increases are discussed in the attached program packages organized on a problem oriented basis. Following the narrative on the packages, a crosswalk table is presented which links the packages to the budget projects.

(1) An increase of $1,199,000 to improve yields and quality of crops through increased research on nitrogen fixation, photosynthesis, and cell biology. ($1,409,000 available in FY 1976)

The total increase of $1,199,000 is for crop production efficiency research.

Objective: To develop an understanding of the biophysical and biochemical constraints that control (1) the capacity of plants, through the process of photosynthesis, to efficiently capture solar energy, (2) the capacity of plants and associated microorganisms to fix atmospheric nitrogen into a useful form, and (3) the quality of the photosynthetic products produced and to develop new methods to translate this understanding into germplasm capable of higher yields of better quality crops.

Need for Increase: The genetic capability of crop plants now being utilized in agriculture limits the efficient use of available soil, water, and energy resources. Only about one percent of the incoming solar radiation is transformed by photosynthesis into plant constituents like carbohydrates, proteins, and fats. Much of this fixed energy is not in the most useful form or is wasted in respiration. Biological nitrogen fixation, which also derives energy from photosynthesis, is of limited efficiency in legumes such as soybeans and is lacking in important crops such as wheat and corn. Manufactured nitrogen fertilizer now consumes over two percent of the natural gas produced in the U.S.; the energy shortage and high fertilizer costs dictate development of alternative sources of nitrogen. The fertilizer nitrogen we now use is responsible for at least 25 percent of our total crop product. Additionally, we must develop plants capable of producing abundant crops when subjected to the stresses of drought, salinity, and other hazards. Better methods to preserve and keep valuable germplasm free of diseases are needed. A modest success in any one of these research efforts could be the breakthrough we need to meet the food needs of the future. Since the value of research results would impact on almost all crops, the dollar benefits could easily be a hundred times more than the research costs. This area of research was rated fourth among all the topics considered by research users at the recent Kansas City Conference on research to meet food needs.

Plan of Work: The research on photosynthesis and nitrogen fixation will develop a more complete understanding of the sites, processes, and mechanisms involved in these fundamental processes. This knowledge is needed to guide genetic modification of plants through new techniques of cell and tissue culture which appear to possess great potential to enhance production potentials and to increase stress tolerance. This basic research will be conducted in various laboratories including the Beltsville, MD., Agricultural Research Center, the Russell Research Center, the Northern Regional Research Center, and others at Raleigh, NC., Gainesville, FL., Urbana, IL., and St. Paul, MN. Scientists from many disciplines will work together investigating ways to increase and exploit the biosynthetic potential of our major field and horticultural crops.

(2) An increase of $1,873,000 to increase yield and quality of food feed grains, oilseeds, cotton, fruits, vegetables and ornamentals, including technologies to meet climate variables. ($5,808,000 available in FY 1976)

The proposed increase will be distributed by program as follows:

(a) An increase of $1,168,000 for crop production efficiency research.

(b) An increase of $705,000 for research on conservation and use of land and water resources, and maintaining environmental quality.

Objective: Increase yields and quality of production of selected crops that are important to human nutrition and well being by (1) improving crop protection against pests responsible for significant losses in yield and quality; (2) reducing crop susceptibility to losses from adverse climatic conditions; (3) improving crop efficiency for utilizing and conserving physical, chemical, and energy resources; (4) improving physical and economic efficiency of mechanized crop equipment; (5) improving nutritional composition and other quality traits through breeding and improved cultural practices; and (6) developing new information, techniques, and management strategies to promote optimal production under changing weather and demand patterns.

Need for Increase: The major part of the land resource base for crop production is already in use for that purpose. Supplies of certain other inputs such as water, nitrogen fertilizers, and some pesticides, are also reaching critical levels. Continued improvement of our productive capacity must come largely from improvement of the biological resources, or the crops themselves. Increase production may be achieved through the reduction of pests losses, reduction in mechanical and harvesting losses, increased efficiency in use of production inputs, improving crop adaptation under varying climates, and increasing crop yield and quality attributes. This increase proposal addresses on a crop-to-crop basis the priority problems with which each crop is faced and attempts to balance the total national program for each commodity.

Areas of research addressed in this increase relate primarily to increasing quantity and quality of production of crop commodities for both national and foreign consumption. Thus, they relate directly to world food needs through export and foreign aid programs. Indirectly, this same research can have a much more significant influence through the development of improved technology for sustaining high levels of production with limited resources. The U.S. cannot expect to continue current export levels for meeting world needs. However, the technologies generated for national production are transferable to other nations either directly, such as for protection technology and equipment, or indirectly through programs of adaptive research, such as incorporation of new sources of pest resistance into native varieties. These technologies are our first line of defense against world hunger and malnutrition.

Plan of Work: Proposed areas of research to promote production of selected crops are specified below.

Corn--New or improved methods will be developed to control the southwestern corn borer and other insects and to increase resistance of corn to insects and disease organisms, especially soil-borne pests.

Wheat, rice and other small grains--Specific weed control practices for control of wild oat will be developed for use in conservation tillage and management systems for small grains and other crops grown in the Pacific Northwest. Research will be initiated for selecting superior performance of rice cultivars on restricted N-fertilizer and other energy inputs. The analytic capabilities of the Rice Quality Laboratory, Beaumont, TX., will be expanded to accelerate selection of improved breeding lines. Research at the Grain Marketing Research Center will be expanded on grain standards adapted for automated assay systems.

Fruits--Research will be expanded on the causes and control of young tree decline of citrus, varietal improvement of pears, and reduction in costs and quality sustained in harvesting and handling deciduous fruits. The research will be conducted as appropriate at locations in Florida, the Middle Atlantic area, and Michigan.

Potatoes--Multidisciplinary research on potato production in Idaho will be augmented by new effort on viral diseases and physiological aspects of quality to help alleviate the decline in quality experienced during the last decade. Research on containment of golden nematode in New York will be increased.

Other vegetables--Improved controls for foliar and viral diseases of vegetables will be developed at Charleston, South Carolina, in conjunction with ongoing research on soil-borne diseases.

Nursery crops--Multidisciplinary research will be undertaken to develop improved production practices for nursery stock in support of the rapidly growing nursery industry in the South. The nursery research and education facilities of the National Arboretum will receive critically needed support to meet statuatory obligations.

In addition to the crop-oriented research, new knowledge and technology will be developed for improved traction equipment and for sustaining agricultural production on fragile soils, forecasting and managing snowmelt runoff, predicting wheat yields under changing climatic conditions, and surveillance of soil moisture and other yield-limiting pest and climatic stress factors through remote sensing. This research will be conducted at the National Tillage Machinery Laboratory at Auburn, AL., and at selected locations in the Southwestern U.S.

(3) An increase of $656,000 for protection against genetic vulnerability of crops. ($2,410,000 available in FY 1976)

The total increase of $656,000 is for crop production efficiency research.

Objective: Minimize the genetic vulnerability of field and horticultural crops to pests and adverse environmental stresses by (1) improvement of the germplasm base of each crop through expanded collection, maintenance, and evaluation; and (2) manipulation of germplasm to improve breeding stocks and accelerate development of resistant varieties.

Need for Increase: In 1972, the National Academy of Sciences issued a report recommending extensive research be conducted on the genetic vulnerability of major crops. In addition, in November 1973, an Ad Hoc Subcommittee of the Agricultural Research Policy Advisory Committee (ARPAC) recommended a concerted national effort to develop ways of improving our base of genetic resources. Areas recommended for remedial action by ARPAC were: (1) expansion of the germplasm base for all crops, (2) improvement of resistance in breeding stocks, (3) improved quarantine measures, (4) monitoring of pest populations, and (5) improved field practices for minimizing losses. ARS established a Germplasm Resources Committee for implementing these recommendations through priority scheduling.

The current proposal represents the third phase of continued improvement of germplasm resources in relation to the several areas identified in the ARPAC recommendations. It would (1) increase the support for expanding and protecting those germplasm collections having highest current priority, and (2) would permit concentrated efforts on improving resistance to priority pests in specific crops and on developing essential research in support of germplasm evaluation.

No area of research is more fundamental to world food issues than the genetic resources of crops. Either directly or indirectly these resources are the source of all food for man and other animals.

Plan of Work: Research will be conducted to broaden genetic knowledge and diversity of maize germplasm, and protect and preserve germplasm collections of sweet sorghum, pecans, barley, strawberries, bramble fruits, hops, mints, sunflower, tobacco, bamboo, and ornamentals. Intensified effort will be made to develop superior trees for urban plantings and to expand collection of endangered native plant species. Fundamental research on the molecular biology of viroids will be expanded and an effective collection facility improved to preserve plant virus collections in support of germplasm disease resistance research. Improved breeding

lines will be developed to improve resistance of corn and sorghum to downy mildew and disease and nematode resistance in grape and stone fruit rootstocks. Research will be conducted at locations appropriate for each crop species in Colorado, Georgia, Indiana, Maryland, Mississippi, North Carolina, North Dakota, Oregon, and Texas.

(4) An increase of $1,334,000 to develop safe and effective pest control technology for horticultural and field crops with emphasis on special uses. ($4,293,000 available in FY 1976)

The proposed increase will be distributed by program as follows:

(a) An increase of $1,079,000 for crop production efficiency research.

(b) An increase of $50,000 for research on conservation and use of land and water resources, and maintaining environmental quality.

(c) An increase of $205,000 for research to improve human health and safety.

Objective: To develop new and innovative or improved materials and methods for controlling insects, weeds, and plant diseases, especially for special and minor uses.

Need for Increase: Research should be expanded immediately to develop new or improved selective pesticides especially for minor or special uses that are not hazardous to the environment and people. Development of biological control agents, especially introduction and release of beneficial parasites should be expanded. Introduction of parasites have been severely limited by available resources. Development of fundamental technology for insect and plant growth regulators should be expanded to support and accelerate developemnt of pesticides to replace those that have been withdrawn from the market because of environmental hazards or to replace those that are hazardous or ineffective today. There is a need to accelerate the development of pest sex attractants and repellents and plants resistant to pests to meet immediate needs.

Problems that result from broad dependence on the use of pesticide chemicals include: increasing prices, association of these chemicals with pollution, development of resistance in pest species and the inadvertant destruction of beneficial species which prey on pests. Ideally, pesticide chemicals should be used as complements to natural control factors. To do this we must develop within the next 10 years technology as part of an integrated control pest management strategy. These include the development of new and improved uses of selective pesticides, biocontrol agents, insect and plant growth regulators, application of sex attractants and repellents, and host plant resistance.

The technologies developed by these research efforts are directly relevant to world food problems by increasing the efficiency of U.S. production. In addition, the control technologies could be readily transferred for adoption by developing nations to reduce the significant agricultural losses to pests. Much of the research effort on pest control is in direct support of government action agencies such as APHIS, Forest Service, SCS, EPA, and certain agencies of the Department of Defense.

Plan of Work: This research would encompass and emphasize (1) improvement of new, selective and environmentally safe control chemicals through formulations and application research of various types of pesticides and plant growth regulators; (2) development of new and unique types of insect hormonal compounds as safe, selective chemicals for control of insects and other agricultural pests; (3) development of attractants and other behavior altering chemicals for pest management programs; (4) expansion of research on importation of biological control agents; (5) determination of the biology and development of control strategies of insect pests of people, and (6) determination of the chemistry of host-plant

resistance. Research on development of improved pest control technologies is concentrated at Beltsville, MD., Gainesville, FL., and Davis, CA. This proposal would provide for consolidation of the research facilities now utilized in Europe and expand our overseas effort on importation of new biological control agents.

(5) An increase of $1,876,000 to increase supplies of high quality animal protein through research on production and disease and insect prevention and control. ($13,693,000 available in FY 1976)

The total increase of $1,876,000 is for animal production efficiency research.

Objective: Improve the efficiency of systems for production of beef, swine, sheep and poultry and production of forage to permit reasonable returns to producers as well as provide meat and animal products of improved quality but at decreasing costs to consumers.

Need for Increase: Population growth and steadily increasing consumption of meat indicate significantly greater requirements for beef and pork and some lamb by 1980 and even greater requirements by the year 2000. Accompaning reductions in production costs are needed to avoid high prices to consumers. The livestock industry harvests over 900 million acres of pasture and range and utilizes over 60 percent of feed grains and 38 percent of protein supplements produced in the United States.

High quality animal protein is an important part of the human diet, supplying almost 70 percent of the protein in the U.S. diets, and will become more a part of the diet throughout the world as the standard of living increases. Reproductive efficiency must be increased so that more feed resources go into growing of meat and less toward the maintenance of producing animals. Increased feed efficiency and use of non-competitive feeds will also reduce costs as feed represents the greatest cost in livestock production.

The efficiency of turkey meat production, which is presently low, could be substantially improved by increasing the reproductive performance of meattype turkey breeders. Lengthening the laying year, increasing the rate of egg production, and the long-term preservation of semen would do much to balance year-round production and reduce the cost per pound of turkey meat.

Although livestock and poultry account for nearly 50 percent of the farm income, ARS is only spending approximately 12 percent of the budget (or $30 million per year) on animal disease research. Losses due to animal diseases are estimated to be in excess of $2 billion annually. As our human and animal populations increase and animal numbers become more concentrated, the relative losses from disease can be expected to increase accordingly.

The request includes funds for bovine brucellosis. The Animal and Plant Health Inspection Service has indicated additional research is needed to provide improved technology to aid in the final eradication of this disease from the country. Other diseases including anaplasmosis, sarcocystis and mycotoxicoses as well as poisonous plants result in significant losses to livestock and poultry.

The request includes funds for research on screwworms to support the APHIS screwworm eradication program, a cooperative program between the U.S. and Mexico. Research will be expanded in order to concentrate on the control of numerous species of ticks and prevention of tick-borne diseases. Ticks continue to be a menace to livestock in the Southwest and pose a threat as disease carriers.

Plan of Work: Interdisciplinary research will be conducted by physiologists, chemists, nutritionists, and geneticists to provide increased research effort on reproductive efficiency, feed efficiency, and nutritive requirements of meat animals as affected by environmental factors and management practices. Consideration of the

quality of the resulting animal products will be a part of the research to improve production efficiency. Research to improve production efficiencies will be conducted at several locations including, U.S. Meat Animal Research Center, Clay Center, Nebraska; Dubois, Idaho; Georgetown, Delaware; and Beltsville, Maryland.

Increased effort in research and diagnosis of foot-and-mouth disease and other foreign animal diseases (including foot-and-mouth disease vaccines; survival of exotic disease viruses in meat products; and diagnostic and training support of regulatory programs) is proposed at the Plum Island Animal Disease Center. In support of Animal and Plant Health Inspection Service programs, research on brucellosis and anaplasmosis at the National Animal Disease Center, Ames, Iowa; and Beltsville, Maryland is planned. Studies of the screwworm will be conducted at Fargo, North Dakota, while the tick research will be conducted at Kerrville, Texas.

(6) An increase of $1,114,000 to improve and conserve soil, water, and air resources for expanding agricultural production and environmental protection. ($16,632,000 available in FY 1976)

The proposed increase will be distributed by program as follows:

(a) An increase of $643,000 for research on conservation and use of land and water resources, and maintaining environmental quality.

(b) An increase of $471,000 for research on watershed development.

Objective: To develop cultural practices and cropping systems that will conserve soil, water, and energy resources for long-term crop and livestock production and simultaneously enhance the quality of the environment in agricultural and adjacent areas.

Need for Increase: The United States is richly endowed with soil and water resources ideally suited for production of agricultural products. Proper care and management of these resources is essential for supplying our own needs for food and fiber, helping achieve a balance between imports and exports, and meeting our social commitments to people in other countries that are less fortunately endowed. However, there are two constraints on use of our soil and water resources; (1) they must be conserved for sustained use, and (2) they must be used in a manner that will protect or enhance environmental quality.

Systems must be developed that allow the land and water resources to be used to the maximum of their capability within those two constraints. Over-use or misuse invites a depletion of the resources and a degradation of enviromental quality. Furthermore, the human, financial, energy, and other resources devoted to agriculture are not likely to be increased. Farmland is being used for the disposal of urban and other wastes with possible impairment of soil and water resources. The proposed increases are needed to help meet these challenges. Federal agencies, states, as well as farmers and ranchers, have expressed a need for these kinds of information.

It has been suggested that a cleaner environment will cost us about $275 billion in the next decade and ARS can do much to reduce these costs. Concurrently, production can be increased and the financial and energy costs of food and fiber for consumers can be reduced. These increases will be used to address several of the highest priority research needs identified by research users at the Kansas City Conference on research to meet food needs: Energy rated first; water, rated third; land, rated eighth.

Plan of Work: Research will be directed specifically at developing new and improved (1) watershed and crop management systems for different climatic zones that will prevent pollution from sediments and chemicals associated with agriculture or from human or animal wastes applied to the land, (2) water management methods and facilities that will enhance the quality of surface and subsurface water supplies

and allow more efficient use of water resources for farming or other beneficial uses, and (3) soil, water, and crop residue conservation procedures such as minimum tillage or "no-till" to protect farm and rangeland from erosion while increasing crop and livestock producing capabilities. Scientists trained in a variety of disciplines will develop and conduct field and laboratory experiments at the following locations: Stillwater and Chickasha, OK.; Sidney, MT.; Weslaco and Big Spring, TX.; Manhattan, KS.; Lafayette, IN.; Brawley and Riverside, CA.; Beltsville Agricultural Research Center, MD.; and Auburn, AL.

(7) An increase of $436,000 to improve production, use and quality of forages and grazing lands to support efficient meat and milk production. ($1,974,000 available in FY 1976)

The proposed increase will be distributed by programs as follows:

(a) An increase of $231,000 for crop production efficiency.

(b) An increase of $205,000 for animal production efficiency.

Objective: Improve yields, quality, pest resistance, adaptation and production practices for forages grown for hay, pasture, and other uses; and develop improved management practices for forage utilization in pasture and range livestock-grazing systems.

Need for Increase: Although ARS expanded its research efforts on forages and rangelands last year, the total effort in these areas is inadequate to meet present and future needs. Further expansion is needed to improve and manage all major ecosystems of western rangelands. Pasture improvements must also be designed separately for major geograhical and climatic areas. Forage breeding to achieve these ends is a time-consuming process that should be initiated now to achieve results in 5 to 10 years.

Although this proposal is directly concerned with meeting domestic demands for meat, it supports technology related to other world issues. Increased use of forages in meat animal production will spare feed grains and protein-rich supplements for export. The technology is transferrable to developing nations to increase food production on marginal lands where none is feasible at the present time.

Plan of Work: Research will include studies of genetic and environmental determinants of quality traits and composition of forages at the U.S. Regional Pasture Labortory, University Park, Pennsylvania. Research in the Western United States will include evaluation of physiological responses of grasses to drought and salinity stresses, expanded research on ruminant utilization of non-competitive feedstuffs, and integrated forage-livestock management systems to improve livestock production on arid rangelands of the Intermountain area. Livestock production will involve beef cattle and sheep at selected loctions in Maryland, Idaho, and Nevada.

(8) An increase of $750,000 to improve human nutrition and food safety, and determine nutrient availability in foods. ($1,336,000 available in FY 1976)

The proposed increase will be distributed by program as follows:

(a) An increase of $203,000 for research on conservation and use of land and water resources, and maintaining environmental quality.

(b) An increase of $196,000 for research to improve human health and safety.

(c) An increase of $351,000 for food and nutrition research.

Objective: Expand research to improve human nutrition and insure the safety of the food supply.

Need for increase: Available information on the nutrient content of foods is inadequate for present needs. The advent of nutritional labeling and efforts to establish a National Data Bank have focused attention on the lack of data on both foods and nutrients and the unsatisfactory state of analytical methods of nutrient analyses of foods. For many nutrients, there are no satisfactory analytical procedures for food analyses.

Essential minerals must be provided from food supplies, but this is not always being met. Marginal deficiencies of zinc, iron, and chromium have been noted in the diets of different population groups. Data are lacking regarding the amounts in foods and the bioavailability of the different forms occurring in foods. Much nutrient data has become obsolete as a result of changes in agronomic practices, new varieties, new processing methods, and changes in warehousing and transportation methods.

Recent FDA regulations on food are aimed at preventing wide variations in levels of nutrients in food crops and in reducing the levels of naturally occurring toxicants and adventitious mycotoxins. ARS must develop more definitive and more rapid means for identifying these toxins and develop methods for their elimination from the food supply. Little or no information is available on the resistance of food crops to toxigenic fungi and the importance of insects as a vector in the spread of these organisms.

Plan of Work: The major thrusts to be undertaken will be the evaluation of nutritional composition of new and processed agricultural products, determination of human requirements of nutrients, identification of natural toxicants and development of new methods for prevention of toxin production in food plants. The Nutrition Institute (NI), Beltsville, Md., will undertake research to fully support the Nutrient Data Center that has been established. At NI and the Northern Regional Research Center (NRRC), Peoria, Ill., joint studies will be undertaken on human requirements for polyunsaturated acids. Information bearing on human requirements for minerals will be developed at the U.S. Plant, Soil and Nutrition Laboratory, Ithaca, N.Y., in connection with investigations of mineral metabolism in plants and animals. On the problem of toxicants, NRRC will study the identification and monitoring of these substances in horticultural crops. The Southern Grain Insects Research Laboratory, Tifton, Ga., will focus on the role of insects as carriers of toxigenic fungi and development of corn genotype with resistance to these fungi.

(9) An increase of $140,000 for tropical and subtropical agricultural research.

($529,000 available in FY 1976.)

The total increase of $140,000 is for tropical and subtropical agricultural research.

Objective: To preserve the World Sugarcane Germplasm Collection and protect world and U.S. crops against fruit fly infestations.

Need for Increase: Sugarcane provides most of the world's sugar and meets about half of U.S. sugar needs. It is vital to insure the genetic base of this crop and provide disease-free stocks to growers. The World Germplasm Collection must be moved to a location that is climatically suitable but isolated from diseases and pests. For example, that part of the collection at the Beltsville Agricultural Research Center is losing about 20 clones per year because of low light intensity and short days during winter. Also, energy costs for greenhouses are great. An expedition to collect and preserve germplasm from New Guinea and surrounding islands will add new germplasm to the collection next spring, which will magnify the need for a suitable site. Also of critical importance to U.S. and world

agriculture is development of control technologies for control of the fruit fly. Several species are serious pests in the Western Hemisphere and some such as the Caribbean, Mexican, Oriental, Mediterranean and South American fruit flies pose great threat to domestic crops. Crop destruction would be explosive if one of these species were introduced into a new environment.

Plan of Work: Clear and prepare 20 acres of land at the U.S. Subtropical Horticultural Station at Miami. Transfer all clones there, including new clones following quarantine and place them under the supervision of professional staff of the Sugarcane Field Station at Canal Point. Develop a combination of technologies for controlling or eradicating fruit fly populations. Techniques to be researched will include parasite release, use of attractants, release of sterile insects, and application of bait groups. Studies will be conducted at isolated areas such as Hawaii or Central America.

(10) An increase of $500,000 to support Animal and Plant Health Inspection Service (APHIS) on boll weevil eradication and concurrent pest management trial programs. ($3,368,000 available in FY 1976)

The total increase of $500,000 is for crop production efficiency

Objective: Expand research on boll weevil to furnish necessary support for APHIS in their boll weevil eradication and concurrent pest management programs.

Need for Increase: An appropriation increase of $500,000 is needed for Fiscal Year 1977 to enable ARS to furnish APHIS the research and pest management support necessary for these programs.

Plan of Work: To support the concurrent boll weevil trial eradication and pest management program in the following areas: (1) collecting, processing and evaluating data on the efficacy and environmental impact of the trials; (2) research on chemical termination to prevent regrowth as a supplement to stalk destruction in high rainfall areas; and (3) research on the economic threshold and decision-making technology. Field work will be conducted in North Carolina on trap design, field eradication, and pheromone testing and production.

Other agencies of the Department will be asked to cooperate, and funds may be provided, to monitor a voluntary Pest Management Control Program and to coordinate research efforts with the State Experiment Stations concurrently with the Animal and Plant Health Inspection Service's Trial Eradication Program.

(11) An increase of $1,656,000 for repair and maintenance of facilities.

Objective: To initiate a long-term program to restore ARS facilities to appropriate standards and to meet Occupational Safety and Health Administration requirements.

Need for Increase: An appropriation increase of $1,656,000 is needed for Fiscal Year 1977 on a recurring basis to bring facilities up to standards and to meet Occupational Safety and Health Administration (OSHA) requirements. Heretofore, funds have not been appropriated for the specific purposes of restoring and maintaining facilities to their proper condition, and immediate needs have been met by redirecting resources from ongoing research programs. This procedure is becoming more difficult to accomplish as other pressing operating needs vie for the same scarce program dollars and resources now available can only provide for the most critical needs. Resources are not available to carry-out a much needed maintenance program to assure that Agency-owned facilities are in compliance with Occupational Safety and Health Standards; to preserve the integrity and appearance of the facilities; to prevent the loss of Federal property; or, to renovate existing facilities to meet changing requirements in performing research.

The severity of the current status of ARS facilities has been verified by a recent study conducted by the Department. A sample of 34 facility locations was surveyed regarding the repair and maintenance condition of facilities. Of the 34 locations covered by this survey, 13 are major or large facilities. The remaining 21 locations represent a good sampling of the total Federally owned ARS facilities. The results of this study are as follows:

Category	Satisfactory (%)	Unsatisfactory (%)	Safety Hazard (%)
Area and grounds	40	33	27
Exterior buildings	21	67	12
Interior buildings	34	45	21
Plumbing	64	24	12
Heating, ventilation of air conditioning	52	39	9
Electrical	70	6	24
Painting	43	57	--
Other (insect damage, etc.)	67	24	9
AVERAGE SCORE	49	37	14

As indicated, over 50 percent of the facilities are in less than adequate condition and in need of attention. Further delay in meeting these needs will only accentuate the necessity later at a higher cost due to further deterioration and higher prices--or even require constructing replacement buildings.

ARS laboratories are in a very poor state of repair. The majority of these buildings are fairly old; many have safety hazards and most need a number of significant repairs. Putting off repairs frequently results in significantly higher decay and higher repair costs in the long-run. Spiraling cost for materials and construction related work has been documented over the years in revised construction limitations contained in the Agency's appropriation language. These revisions were presented and justified by the Department and approved by the Congress. Although repairs and maintenance are not confined to these restrictions, the rising prices are applicable. The chronology of these revisions is reflected below:

	FY 1971	FY 1972-1974	FY 1975-1976	FY 1977 Est.	Percent Increase 1977 Over 1973	Percent Increase 1977 Over 1971
"Cost of Constructing any one building not to exceed" ..	$25,000	$40,000	$ 50,000	$ 65,000	63	160
"Except for six buildings, not to exceed"	55,000	80,000	100,000	125,000	56	127
"Alterations, not to exceed" ..	7,500	15,000	15,000	25,000	67	233

Plan of Work: The amount requested for Fiscal Year 1977 represents the minimum level of funding necessary to effectively initiate a long-term program to restore our facilities to an acceptable level. This estimate is based on a survey of all research facilities to determine specific needs in the program planning period. The survey information can be used as the basis for implementing a repair and maintenance program in a timely and orderly manner and insure that Agency-owned facilities are maintained at acceptable levels. An adequately financed scheduled maintenance plan will assure that safety requirements are satisfied; that hazardous and unsafe working conditions are corrected; and that changing research program requirements are satisfied.

(12) An increase of $2,955,000 for annualization of pay increases effective in FY 1976.
($6,629,000 available in FY 1976)

(13) An increase of $304,000 for space rental costs pursuant to P.L. 92-313.
($1,758,000 available in FY 1976)

Need for Increase: Pursuant to P.L. 92-313, the Agency is required to budget for costs associated with occupied GSA controlled space. The 1976 Appropriation Act again limited the Department to paying 90 percent of the Standard Level User Charge used in computing the 1976 request. The funds requested in the 1977 Budget would (1) restore the full financing necessary to meet estimated billings provided by the General Services Adminstration, and (2) provide for additional general rate increases anticipated during FY 1977.

(14) A decrease of $1,500,000 due to the termination of dairy herd improvement.
($1,500,000 available in FY 1976)

The total decrease of $1,500,000 is for animal production efficiency research.

The decrease would terminate the Department's responsibility for producing and disseminating genetic appraisals of dairy sires and cows. The Department will work with the National Cooperative Dairy Improvement Association to assure there is a smooth transition of functions and no adverse effect on the program. The decrease reflects the Agency's continued efforts to transfer operational responsibility for proven projects and programs to the private sector.

(15) A decrease of $2,000,000 in marketing efficiency research.
($52,046,000 available in 1976)

The proposal results from the intention to eliminate those projects which can be conducted by industry and the need to redirect scarce Federal resources to highest priority projects and, to eliminate projects which have the lowest priority in the areas of food and fiber storage, processing, transportation, distribution and new product development. In selecting projects to reduce or terminate, emphasis will be given to those areas where private industry has or could develop strong research and development efforts.

(16) A decrease of $10,395,000 to eliminate non-recurring facility items.
($10,395,000 available in FY 1976)

Need for Decrease: The 1977 Budget Estimates provide for a decrease of $10,395,000 to eliminate non-recurring amounts provided for construction of facilities in 1976. These funds are available until expended and therefore not included in the FY 1977 request.

Following is a cross-reference table relating the proposed increase packages to budgetary projects.

Cross Reference of Proposed Increases and Decreases to Budgetary Projects
(Dollars in Thousands)

Proposed Increases (Packages)	Budgetary Projects: Total Request	Animal Production Efficiency	Crop Production Efficiency	Tropical and Subtropical Agriculture	Conservation and Use of Land and Water Resources	Watershed Development	Marketing Efficiency	Expand Agricultural Exports	Food and Nutrition	Improve Human Health and Safety	Consumer Services	Housing	Support Services for Other USDA Agencies
Improve yields and quality of crops through increased research on nitrogen fixation, photosynthesis, and cell biology	1,199		1,199										
Increase yield and quality of food and feed grains, oilseeds, cotton, fruits, vegetables and ornamentals, including technologies to meet climatic variables	1,873		1,168		705								
Protection against genetic vulnerability of crops	656		656										
Develop safe and effective pest control technology for horticultural and field crops with emphasis on special uses	1,334		1,079		50					205			
Increase supplies of high quality animal protein through research on production and disease and insect prevention and control	1,876	1,876											
Improve and conserve soil, water, and air resources for expanding agricultural production and environmental protection ..	1,114				643	471							
Improve production, use and quality of forages and grazing lands to support efficient meat and milk production	436	205	231										

Cross Reference of Proposed Increases and Decreases to Budgetary Projects

(Dollars in Thousands-continued)

Proposed Increases (Packages)	Total Request	Animal Production Efficiency	Crop Production Efficiency	Tropical and Subtropical Agriculture	Conservation and Use of Land and Water Resources	Watershed Development	Marketing Efficiency	Expand Agricultural Exports	Food and Nutrition	Improve Human Health and Safety	Consumer Services	Housing	Support Services for Other USDA Agencies
Improve human nutrition and food safety, and determine nutrient availability in foods	750				203				351	196			
Tropical and subtropical agricultural research	140			140									
Research to support Animal and Plant Health Inspection Service trial program on eradication and control of boll weevil	500		500										
Repair and maintenance of facilities	1,656	315	599	4	144	60	363	16	64	86	4	1	
Annualization of pay increases effective in FY 1976	2,955	609	1,080	3	273	122	605	20	101	131	6	3	2
Payment to GSA for rental of government-owned or leased space	304	57	98		30	23	65	2	14	10	4	1	
Dairy herd improvement	-1,500	-1,500											
Marketing research	-2,000						-2,000						
Total Proposed Increases	11,293	1,562	6,610	147	2,048	676	-967	38	530	628	14	5	2

STATUS OF PROGRAM

The Service is a mission-oriented agency concerned with research to insure an abundance of high quality and reasonably priced agricultural products to meet the needs of an expanding domestic and world economy, and contribute to continued improvement in the American standard of living. The Service uses coordinated, interdisciplinary approaches to conduct basic, applied, and developmental research in the fields of livestock, plants, soil-water-and-air resources, environmental quality, marketing and use of agricultural products, food and nutrition, consumer services, rural and international development, and agriculturally related health hazards, including food safety.

Research is conducted at numerous locations in the States, Puerto Rico, Virgin Islands and in several foreign countries. Much of the research is conducted in cooperation with the State agricultural experiment stations, other State and Federal agencies, and private institutions.

RESEARCH ON ANIMAL PRODUCTION

Current activities: Research is conducted to improve and increase the production of livestock and livestock products through improved genetic and reproductive capacity, feeding and management practices and to develop better methods for controlling diseases, parasites, insects and other pests, and hazards.

Prices and consumption of livestock and livestock products have risen very rapidly in the past several years, and a continuing rise can be expected. This is not only true in the United States, but worldwide. Consequently, there is a need for new technology to enable livestock producers to achieve greater production to meet the demand and at the same time reduce their costs. As these lower costs are passed on in the market place, consumers will benefit.

Selected examples of recent progress: A description of these examples follows this index.

Animal Production Efficiency Research

Animal Production Efficiency Research

1. Zinc Supplemented Diets Increase Weight of Range Cattle. ARS scientists at Kimberly, Idaho, found that both cows and calves receiving zinc supplements in their diets gained significantly more weight each day than

did animals receiving no zinc. Cows receiving the zinc supplements during the 6 months test period gained an additional 40 pounds. Zinc-receiving calves gained 18 pounds more than calves with inadequate zinc diets. This weight-gain response shows that range cattle do not obtain adequate zinc in their normal diet, and are hampered in their growth because of it. If only 10 percent of the 23 million beef calves raised in the 17 Western states received zinc supplements to their diet, there could be an additional 45 million pounds of beef on the market each year.

2. Control of Horn Flies from Cattle. A drinking-water treatment effectively controlled larvae of the horn fly in the manure of 600 head of cattle on the island of Molokai, Hawaii. Sterile horn fly males were reared and irradiated at the U.S. Livestock Insects Laboratory, Kerrville, Texas, and were shipped to Hawaii and released in the cattle grazing area, at the rate of about 1.5 million per week. The combination of the treatment and release over a 15-week period reduced the reproduction of native horn flies to zero. Ten weeks after the end of the release, cattle on the ranch still did not have horn flies. This technology is applicable for horn fly control in areas where these insects are a problem on beef and dairy animals. Horn flies cause an estimated annual loss of $35 million to the beef and dairy industry in the United States.

3. Foot-and-Mouth Disease Vaccine from Fraction of Virus Particle. For the first time, foot-and-mouth disease (FMD) vaccine has been made from a fraction of the protein coat of the FMD virus rather than from the whole infectious virus. This vaccine is a milestone in FMD research because for the last 40 years all FMD vaccines have been made from the entire virus particle that includes the internal infectious nucleic acid. Often, vaccinated animals have become infected due to the fact that the inactivation process did not kill the infectious nucleic acid of the virus. Based on this research, future vaccines may be made from fractions of a single virus protein and may even be synthesized. This research opens new avenues for the control of foot-and-mouth disease which poses a constant threat to the livestock industry of the United States. In addition, it is feasible that similar safe vaccines can be produced for some human virus infections such as polio.

4. A New Chemical Detoxification Mechanism. ARS Scientists at College Station, Texas, have discovered a new chemical reaction that renders potentially dangerous compounds harmless and may contribute to the understanding of chemically induced cancer. Some chemical compounds have a peculiar structure in the molecule called an "epoxide," a number of cancer-causing compounds have this structure. Ruminants--cattle or sheep--apparently have an enzyme in their digestive systems that can change this potentially dangerous "epoxide" to a non-dangerous chemical form called an "olefin." Historically, there are 4 other known chemical methods of detoxifying poisons; each method has been of great value in treating toxicity and in understanding the mechanism of action. Since these chemical reactions are the only known way that poisons in animals or people are rendered harmless and excreted, this newly discovered method adds a new dimension in metabolism, detoxification, and excretion. Additionally, this chemical discovery may prove of even greater value in understanding the mechanisms of cancer-causing chemicals.

5. Beltsville Developments May Revolutionize Artificial Insemination of Swine and Chickens. Frozen semen from genetically superior boars is now being commercially marketed both in the U.S. and abroad. An extender and a freezing method for poultry semen has great commercial demand. Both the

freezing and thawing methods and the semen extenders were developed at the Beltsville Agricultural Research Center. The freezing of boar semen makes possible the widespread use of superior boars with outstanding records of feed efficiency and growth rates, thereby making pork production more efficient. Before development of the Beltsville method, boar semen could not be successfully stored frozen. Thus, pork producers had to keep their own boars, severely limiting the use of superior animals. In poultry, the use of the semen extender developed at Beltsville allows insemination of up to 300 hens from the ejeculate of one rooster compared to 50 hens using undiluted semen. Under natural mating conditions one rooster is needed for every 10 hens. Use of the extender allows greater genetic progress and more efficient broiler production since fewer males need be kept and less feed is consumed. The freezing procedure for chickens' semen is satisfactory for foundation lines and expected improvements will allow its use for commercial production.

6. Earlier and More Accurate Genetic Evaluation of Dairy Bulls and Cows. The new USDA-Dairy Herd Improvement Association Modified Contemporary Comparison, a method of evaluating dairy bulls and cows, was implemented to provide complete and unbiased estimates of genetic producing ability for approximately 20,000 dairy bulls and over 750,000 dairy cows. This new procedure enables the identification and use of genetically superior bulls 6 to 8 months earlier in their life than was previously possible. The primary impact of this entire program is the identification of genetically superior bulls for use in artificial insemination (AI). Through the use of USDA genetic evaluations the average genetic superiority of these bulls has been increased from 122 pounds of milk in 1966 to 452 pounds of milk in 1975. Over one-half of the dairy cattle population of the United States is presently being artificially bred by these bulls. It is presently estimated that dairymen are benefiting by approximately $265 million in extra income over feed costs from the use of the genetically superior bulls identified through this program. This program has also had a major impact on the increases in export of dairy cattle and bull semen. Now that the program has been successfully developed, ARS is planning to shift the program responsibility to industry in 1977. Such a transfer would have industry maintaining the necessary data.

7. Methods Developed to Reduce Loss to Poultry Respiratory Disease. Airsacculitis, an inflammation of the air sacs in chickens' lungs, resulted in the condemnation at slaughter of over 8 million broilers in 1974. This inflammation is primarily due to a bacteria infection in conjunction with some respiratory viruses. Condemnation records clearly show that the incidence of airsacculitis increases in the winter months. Research clearly indicates that the condemnations due to airsacculitis in infected broilers may be reduced in winter months by increasing the temperature in the poultry house. These relationships provided evidence that environmental conditions play an important role in the development of airsacculitis. Recent studies at the ARS Southeast Poultry Research Laboratory, Athens, Georgia, have defined the influence of temperature and humidity on this disease. Research showed that infections were reduced from 45 percent to 9 percent by increasing the temperatures from 45 degrees to 90 degrees, whereas, humidity had minimal influence on the incidence of the disease.

8. Potential Control Method Developed for Calf Parasitic Disease. Research at the ARS Regional Parasite Research Laboratory in Auburn, Alabama, has resulted in the development of a potential biological agent for the control of bovine coccidiosis, a disease that weakens or kills calves between the ages of 3 weeks to 6 months. This biological agent, prepared from

animals surviving coccidiosis, is called the bovine "transfer factor." "Transfer factor" is a different type of immunity from the normal vaccination procedure. It stimulates or enhances immunity regulated by the cells themselves. Transfer factor treatment was found to reduce the severity and mortality of the disease when given to experimental animals before infection. These findings indicate the potential use of this biological agent, bovine "transfer factor," in controlling this parasitic disease that causes heavy economic losses to the livestock industry of about $60 million yearly. Since human "transfer factor" has been found to control many human diseases, bovine "transfer factor" may also be useful in controlling other parasitic and nonparasitic diseases.

9. Twice-A-Year Lambing Research has Increased Lamb Production 40 Percent and Experimental Flocks. By treating ewes, who have recently given birth, with a saturated sucrose solution, twice-a-year lambing can become a practical reality. Administering a saturated sucrose solution enhances sperm passage in the reproductive tract of ewes. ARS scientists at the U.S. Sheep Experimental Station, Dubois, Idaho, have experimentally achieved a 40 percent increase in production and prospects are excellent for additional increases. One of the principal costs for livestock production is the maintenance of breeding stock. If sheep can give birth to lambs twice a year instead of once, the producers' cost per unit of production will be dramatically reduced. The cost reduction will enable producers to increase their volume which in turn benefits the processors and increases their efficiency. The reduced costs and increased efficiency of both producer and processor will mean lower prices for the consumer.

10. Improved Selection Procedures Reduces Calving Difficulties for Beef Cattle. Decreased emphasis on birth weight in selecting cattle for breeding should reduce problems associated with calf size at birth like calving difficulty and mortality at or near birth. Calving difficulties are especially important under range conditions where assistance during calving is not practical. About a 1 percent increase in birth weight increases the new calf cost about $2 due to greater calf mortality and calving difficulty. A study at the U.S. Meat Animal Research Center, Clay Center, Nebraska, indicates selection for an index that encourages yearling weight and discourages birth weight would make it possible to continue to increase yearling weight, an important economic trait, with little change in birth weight.

11. Important Causes of Swine Reproductive Failure Identified. ARS scientists at the National Animal Disease Center have identified the swine virus, porcine parvovirus, which may be one of the most economically important infectious causes of swine reproductive failure. If sows or gilts are exposed to porcine parvovirus during gestation, the virus may move via the placenta to the fetus and cause its death. Many of these reproductive failures have previously been unexplained. Reliable and sensitive procedures have been developed at NADC for diagnosing reproductive disease induced by porcine parvovirus, and control appears feasible.

In additional studies, pseudorabies (a virus disease that can infect most mammals) is another disease that causes a significant number of reproductive failures and death of newborn pigs. Recently, a test has been perfected which causes a hypersensitive reaction in positive pigs similar to that of the tuberculin test in humans or cattle. This appears to be a specific test for pseudorabies and should be a great help in the recognition, control, and eradication of swine infected with pseudorabies.

RESEARCH ON PLANT PRODUCTION

Current activities: Research is conducted to improve productivity and quality of food, feed, forage, and fiber crops; florist and nursery crops; and turf. Emphasis is on research to improve genetic stocks and varieties, increase yields and quality of crops, improve mechanization and crop production practices, enhance environmental quality, and improve crop protection technology, including biological and chemical methods to control diseases, nematodes, insects, and weeds, and to alleviate the effects of adverse environmental conditions through hardier plants. Both research and training are carried on in related areas of tropical and subtropical agriculture.

The need for an ever increasing supply of wholesome nutritious foods and desirable fibers at lower prices is a national problem. Considering the broad array of soil and climatic conditions throughout the United States, and the large number of economic crops, there is a need for a multidisciplinary research approach to developing new basic concepts to achieve these goals.

The quality of our environment can be improved by the development, appropriate use, and care of attractive shelterbelt screening, ornamental trees, shrubs, turf, ground covers, and flowers. There are an estimated 75 million acres of cropland affected by wind erosion, the adverse effects of which could be reduced by shelterbelt screening. New knowledge to preserve attractive and eliminate unattractive environmental conditions is needed by rural and urban property owners throughout the nation.

Selected examples of recent progress: A description of these examples follows this index.

Plant Production Efficiency Research

Tropical and Subtropical Agricultural Research

21. Germplasm Maintenance and Distribution
22. Improved Tropical Production of Beans and Cowpeas Through Disease and Insect Control
23. Evaluation of Plantain Varieties and Development of Production Techniques

Plant Production Efficiency Research

1. Natural Enemies Established to Control Two Serious Weed Pests. Biological control of Russian thistle (tumbleweed) and halogeton, a toxic weed closely related to Russian thistle, may be possible because of a moth, Coleophora parthenica, introduced from Pakistan by ARS scientists at Albany, California. In 1973, the Agency, through its Biological Control of Weeds Laboratory at Albany, established the moth along highway rights-of-way in California in an attempt to control the costly, bothersome, unsightly, and sometimes dangerous thistle. The moth has since become well established at several field sites and is beginning to show promise for control. The insect feeds only on Russian thistle and closely related weeds. Attempts are now being made to establish it on halogeton. If the moth can be successfully established on a large scale, it will benefit farmers and ranchers, as well as highway and water resource departments that are responsible for Russian thistle control. The weed costs California taxpayers alone more than $500,000 a year in highway maintenance costs and countless millions of dollars throughout the country. Russian thistle is a widespread weed of the western and midwestern U.S. It serves as a favored alternate host plant for the beet leafhopper, which transmits "curly top virus" to sugarbeets, tomatoes, melons, and many other crops. Halogeton infests millions of acres of semiarid rangeland in the western U.S. This plant is toxic to livestock, particularly sheep, and thus infested rangeland is rendered almost useless for livestock production.

2. Mediterranean Fruit Fly on Lanai, Hawaii, Controlled in Pilot Study. Over 99 percent reduction in native Mediterranean fruit fly (medfly) population on Lanai was obtained as a result of sterile medfly releases at the rate of about 20 million per week by ARS scientists. The resulting high suppression level has been maintained for 6 months with aerial drops of sterile pupae. No medflies were recovered from a total of 10,000 guava fruits between February and May 1975. Native fly movement from Maui to Lanai has been confirmed but, if complete isolation were possible, the medfly would have been eradicated from Lanai. In case of an outbreak, the method can be used to eradicate the medfly anywhere it might occur in the U.S. and protect the fruit industry from this insect. Value of the Hawaiian fruit crop, excluding pineapples, amounts to about $7 million. The absence of fruit flies, it is speculated, could bring that total to perhaps $23 million.

3. Increased Protein, Bred into New Wheats. New varieties of wheat that eventually may contribute significantly to the nutritional status of about a third of the world's people who depend on wheat as a major source of calories and protein have been developed cooperatively by ARS and State agricultural experiment stations. A hard-red winter wheat variety, Lancota, developed at Lincoln, Nebraska, has inbred potential for high yields of grain possessing 10 to 20 percent more protein than ordinary wheats. The protein is in the part of the grain made into white flour, so it will not be lost in the milling process. Lancota has excellent milling and baking properties and does not depend upon use of nitrogen fertilizer for higher grain protein. It would provide about 100 million more pounds of protein each year if grown on all of Nebraska's wheat acreage. Kitt,

a semidwarf hard red spring variety developed at St. Paul, Minnesota, produces 14 percent more protein per acre than the variety Era. If grown on the acreage devoted to Era in 1974, Kitt would provide about 72 million additional pounds of protein. Kitt has the same high yield potential as Era, which yields 15 to 30 percent more grain than previously grown tall varieties. An experimental durum wheat, developed at Fargo, North Dakota, yields semolina (flour) with 2 to 3 percentage points higher protein content and greatly increased dough strength. This variety may overcome objections of Italian spaghetti and macaroni manufacturers who have criticized the low gluten-protein content of present durums imported from the United States. The new durum wheat may also be suitable for bread.

4. New Spinach Varieties Resistant to Leaf Diseases and Freeze Damage Released for Commercial Production. New spinach varieties (Wintergarden, Jewel, and Crystal), resistant to white rust, were released for spinach production areas of Texas where white rust disease is a perennial production problem. Field trials showed that these white rust resistant varieties are adapted to the Arkansas-Oklahoma and Tennessee spinach production areas. Wintergarden, Jewel, and Crystal are also highly resistant to 2 races of blue mold and to freeze damage. All 3 varieties are suited to machine harvesting and leaf quality is excellent for the fresh market, canning, and freezing. In yield trials without using a fungicide during 2 years at Crystal City, Texas, all 3 varieties each produced in excess of 10 tons per acre of prime spinach, while commercially grown entries were not marketable due to white rust disease. At an average price of $13 per hundred weight, the new varieties provide a potential value of $2,600 per acre to the producers.

5. A New, Superior Potato Variety Developed. Atlantic, a new potato variety with many superior qualities, yields 30 to 70 hundredweight more per acre than varieties currently grown in Florida, Virginia, New Jersey, and Maine. Preliminary trials indicate that Atlantic is also adapted to Alabama, California, Ohio, and Wisconsin. Atlantic is highly resistant to some of the worst pests of potatoes, including the golden nematode, virus X, race 0 of late blight, and tuber net necrosis. It is also tolerant to scab and leafhopper feeding. Specific gravity of the potatoes is unusually high, a measure of the high quality necessary for potatoes to be used successfully in processed products. Accordingly, tests showed that chip and french fry qualities of Atlantic potatoes are high. Palatability of both baked and mashed forms of Atlantic is also highly acceptable.

6. Genetic Vulnerability of Corn Reduced. The Southern corn leaf blight epidemic in 1970 focused public attention on scientific concerns about the genetic vulnerability of corn. Nearly all hybrids grown in the United States contain similar inbred lines of parent material, all of which is susceptible to a number of serious diseases or other pests. The parent populations of hybrids have been improved by ARS scientists at Ames, Iowa, through small, step-wise changes that are made in breeding populations by repeatedly selecting plants for desired traits and intensifying the traits by mating the selected plants. Results show that these selection procedures do improve the performance of the breeding populations. Sampling of the improved populations provides inbred lines not related to others used. Genetic vulnerability has been reduced. For example, line B73, developed from the fifth cycle of selection, is superior to B14, developed from the original unselect population. Both lines are extensively used in commercial hybrids and help to reduce the susceptibility of the crop to disease outbreaks of epidemic proportions.

7. Continued Improvement Made in Rust Resistance of U.S. Wheats. Effective resistance to stem rusts is an absolute necessity in the U.S. spring wheat area. During the past 20 years, success in preventing rust epidemics has kept bread on the American family table. ARS scientists have gained deeper insight, not only into the genetics of rust resistance in wheat, but have also improved their knowledge of the genetic system of the parasitic rust fungus. This knowledge has improved their ability to manipulate genes for resistance and has accelerated the development of new resistant varieties. During 1975, cooperative efforts of ARS and State scientists culminated in the release of 2 new rust resistant varieties for the North Central Region. Prior to 1955, stem rust caused 4 devastating national epidemics and several severe regional epidemics.

8. New Biological Methods Control Tobacco Diseases. ARS scientists at Oxford, North Carolina, demonstrated that acquired resistance of tobacco to serious diseases could be induced by special techniques. When tobacco cultivars with hypersensitive type of resistance to tobacco mosaic virus were inoculated with the virus, they did not develop mosaic disease but developed enzymes that reduced their susceptibility to a fungal disease, brown spot. The incidence of brown spot disease was reduced 50 percent. Similar acquired resistance was induced when nonpathogenic spores of the brown spot fungus were sprayed on the plants a few days prior to natural or artificial inoculation with pathogenic spores. The presence of the nonpathogenic fungus stimulated germination of the pathogenic spores but prevented their damaging penetration into the leaf tissue. Field practicality of these techniques is being tested as a means of disease control without hazard to the environment.

9. Superior Strains of Nitrogen-Fixing Bacteria Increase Yields of Soybeans. One of the most promising biological means of increasing food production lies in helping plants to create their own fertilizer. Soybeans, for example, are able to capture nitrogen from the air with the help of rhizobia, soil bacteria which fix nitrogen in the plant's roots. Since the plant is manufacturing its own fertilizer, the need for expensive chemical fertilizers is reduced. Some strains of rhizobia are more efficient than others in capturing free nitrogen for use by soybeans. Scientists at Beltsville, Maryland, have found Rhizobium japonicum, a recent import from India, to be a highly efficient strain. In field tests conducted where soybeans had not been planted previously (thus there were no other competing rhizobia), yields of 8 soybean varieties inoculated with the new strain were 30 percent above yields of the same varieties inoculated with other efficient strains of rhizobia from the Beltsville collection. On some varieties the new strain produced 50 to 75 percent more seed than the uninoculated controls whose yield was derived entirely from nitrogen supplied from the soil. This discovery can impact the future of all soybean production.

10. New Type of Plant Pathogen Discovered. An entirely new group of plant pathogens has been discovered by ARS scientists. For many years, scientists believed that the economically important "yellows" type diseases of plants were caused by viruses. More recently it has been suggested that these diseases are caused by Mycoplasmas. Now, as a result of research of the Plant Virology Laboratory, the new microorganism--the first of its type--has been recognized and identified as the causal entity of one of these diseases (corn stunt). The ARS scientists proposed the name of "spiroplasma" for the new organism. The discovery of the corn stunt spiroplasma marked the beginning of a new field in microbiology. It forced a new look at diseases of unsolved causes that led to the discovery of spiroplasmas as previously unrecognized pathogens in insects, avian species, and mammals.

This research has also provided a practical tool for disease diagnosis by microscopy and established techniques by which a specific organism can be isolated and cultivated in vitro. A search for the presence of similar organisms associated with other plant diseases resulted in the recognition of another spiroplasma as the causal agent of "stubborn" disease of citrus.

11. Sugarbeet Breeding Lines Developed with High Rhizoctonia Root Rot Resistance. Intricate breeding techniques and genetic studies have enabled ARS scientists in Colorado and Michigan to produce new breeding lines of sugarbeets with greatly improved resistance to rhizoctonia root rot. This disease annually destroys about 5 percent of the U.S. sugarbeet crop--a loss of about $25 million. Rhizoctonia root rot causes early death of seedling sugarbeets, but more importantly it causes roots and crowns to rot in older plants. Progression of the disease eventually kills the plants. Because this root rot is caused by a soil-borne fungus that is present in nearly all soils, some growers could experience a total crop loss if the right combinations of temperature, moisture, and soil type occur at the same time and place. Currently, there are no effective chemicals to control the disease; cultural control by crop rotation is of limited effectiveness.

12. Method for Control of Parasitic Wasp Protects Leafcutter Bee. Sapyga wasps are tiny parasites that indirectly threaten the alfalfa industry. ARS scientists have developed a trap that effectively controls this pest. The protein-rich hay and forage crop, alfalfa, can only be pollinated by insects. Alfalfa leafcutter bees are one of the best of the alfalfa pollinators, but in recent years have suffered terrible losses because of Sapyga wasps. Consequently, the alfalfa seed crop has suffered too. Sapyga wasps deposit their eggs in leafcutter bee cells. Wasp larvae hatch, destroy host eggs, consume bee provisions, damage bee nests and diminish the chances of bee survival. The ARS trap consists of a box that utilizes black light to attract insects to a space so narrow it allows only the Sapyga wasps to enter. Wasps entering the trap are either embedded in petroleum gel or drowned in trays of oil. In 2 years, traps like this reduced the rate of wasp parasitism in a commercial leafcutter bee operation from 74 percent of the cells prior to controls, to 40 percent after the first year, to only 3 percent after the second year. Over 800,000 wasps representing a potential $100,000 loss to the operation in cost of bees and reduced pollination, were captured during the 2-year test period.

13. Candidate Insecticides Effective Against Insecticide Resistant Tobacco Budworms on Cotton. A new class of insecticides, the synthetic pyrethroid compounds, included in ARS Beltwide Field Tests in 1975, were found highly effective against the tobacco budworm and bollworm complex. These new compounds are critically needed as previously recommended insecticides have failed to control tobacco budworms in Texas, Louisiana, Mississippi, and South Carolina in recent years. In Louisiana alone, late planted cotton suffered losses to the resistant-tobacco budworms ranging from severe to total destruction and the estimated loss was $18 million. When registered by EPA, one or more of these experimental compounds will provide a badly needed means of controlling resistant-tobacco budworms.

14. Sorghum Hybrids Resistant to Greenbugs Will be Available Commercially in 1976. The greenbug - long an important pest of small grains - developed a new biotype that became the major pest of sorghum in 1968 in the Midwest and Southwest. Then, in 1974, resistance to the commonly used insecticides became pronounced. Fortunately, ARS entomologists at Stillwater, Oklahoma, had been able to locate plant resistance in sorghum by using techniques

developed earlier for small grains. Subsequently, ARS in cooperation with Oklahoma State University released resistant germplasm developed from 2 breeding lines. The breeding line SA-7536-1 and KS-30 either singularly or in combination have been incorporated into high-yielding hybrids by commercial seed companies. As a direct result of these research efforts, several resistance hybrids will be available commercially to growers in 1976. Research has shown that these hybrids should adequately protect sorghum from greenbugs, thus eliminating the need for insecticides and preserving the populations of natural beneficial insects. The resulting savings in this development is estimated at about $14 million annually to sorghum producers in yield losses and chemical control expenditures.

15. Wasps Used to Control Alfalfa Weevil in the Northeast. The use of parasitic wasps obtained in Europe has eliminated the need for insecticides over an estimated 1.4 million acres of alfalfa; more than one-third of the total grown in the 13 States in the Northeast. The saving to farmers is estimated at $7 million per year. Such savings help hold the line on rising operating costs that threaten to drive dairy farmers out of business or force up prices that ultimately would be passed along to the consumer. Several species of the pest-fighting parasitic wasps have been obtained in Europe by the ARS entomology laboratory located near Paris, France. Two of the species are being spread by ARS and cooperating State entomologists. Two other species are spreading without man's aid. The wasps seek out the alfalfa weevil or its larvae, and deposit their eggs. Upon hatching, the wasp larvae parasitize their hosts and soon kill them. Consequently, damage to alfalfa by the alfalfa weevil has greatly declined from New England to Delaware, and as far west as Ohio and Michigan.

16. Biological Control Agents Show Promise Against Disease-Bearing Mosquitoes. Mass production facilities were constructed for rearing 300,000 Culex pipiens mosquitoes and millions of infective stage nematode parasites per week at the Nematology Laboratory, Beltsville, Maryland. The parasites that kill 60 species of mosquitoes, including the carriers of encephalitis, yellow fever, malaria, and dog heartworm, were distributed by the millions to mosquito experts in 6 localities for field testing. An 80-95 percent kill was noted upon application to field ponds containing these mosquitoes. The parasite became established in some of the treated pools and recycled during the summer. Surveys next summer will show whether or not the established parasites survived the winter in Maine, New York, Massachusetts, New Jersey, and Maryland. The Fairfax Biological Lab., Clinton Corners, New York, has expanded their plant for production of the parasite commercially under the label "Skeeter Doom." Three other companies have shown commercial interest. The product has a shelf life of 1 year, is inexpensive to produce, easy to use, and has no adverse effects on the environment. Unlike some other species of nematodes, these parasitic agents are harmless to humans, animals, plants, fish, and beneficial insects such as bees.

17. Insect Growth Regulators Coming into Commercial Use. The recent registration of an insect growth regulator, methoprene (Altosid), for mosquito control brings to fruition approximately 40 years of basic research on insect hormones by the Department, universities, and industry. Another insect growth regulator under development is Dimilin which shows considerable promise for use against the boll weevil, gypsy moth, and soybean insects. When applied to cotton in cottonseed oil at 4- or 5-day intervals, Dimilin suppressed the boll weevil population in excess of 99.9 percent. This insect growth regulator does not kill adult weevils but prevents their eggs from hatching. Dimilin appears to be free of serious hazard to mammals and to many beneficial species of insects and other arthropods.

18. Research Doubles First Line of Defense Against Corn Borer. Hybrid seed corn with bred-in resistance to both generations of European corn borer soon will be available to farmers. ARS scientists at the European Corn Borer Research Laboratory, Ankeny, Iowa, and at Iowa State University, Ames, have developed corn breeding lines that State, Federal, and private breeders can use in developing hybrids resistant to both corn borer generations. Genetic resistance to feeding is the first line of defense against corn borer. Until now, however, resistance to first-brood feeding in June and early July and second-brood feeding in late July and early August could not be offered in one commercial hybrid. ARS scientists found this dual resistance in exotic corns from Columbia, South America, and with commercial breeders, bred it into parent stocks. This research reduces the need for insecticides in controlling European corn borer.

19. Improved, Less-Costly Mosquito Control. Research to reduce costs and improve efficiency of application equipment for mosquito control is coming to fruition. Benefits are accruing throughout the U.S. and in other parts of the world by adapting ultralow volume techniques to replace thermal fogging units, a concept developed by ARS scientists at the Insects Affecting Man Research Laboratory at Gainesville, Florida. Lowndes Engineering Company first undertook commercialization of the equipment, and now 3 other companies are also producing the equipment. This development, and concurrent research by ARS on droplet size of insecticidal aerosols, has resulted in savings of 65 to 75 percent in costs. Based on the number of new machines now in use, estimated annual savings of $15 to $35 million were accrued this year alone. Savings result from reducing the required amount of insecticide by 50 percent, eliminating fuel oil as a diluent (also an energy saving accomplishment), using storage and mixing tanks, and frequent reloading. Fuel consumption of vehicles, pumps, and motors is also reduced as well as traffic hazards created by fogs of insecticide.

20. Hybridizing American Elm With Other Elm Species. A cross between an American elm and a Siberian elm has for the first time produced seeds which germinated into seedlings that may have inherited resistance to Dutch elm disease from their Siberian elm parent. As the disease was ravaging American elms more than 30 years ago, researchers in North America and Europe attempted to cross the susceptible trees with other elm species that were resistant. The Siberian elm used for the successful cross in 1975 grew from a seed which, 10 years earlier, ARS scientists at Beltsville, Maryland, had chemically treated to double the tree's chromosome number to match the chromosome number of American elms. At Delaware, Ohio, where the Siberian elm grew to fruiting size and the cross was developed, scientists expect to complete evaluation of disease resistance and determine whether the seedlings are truly hybrids within a few years.

Tropical and Subtropical Agricultural Research

21. Germplasm Maintenance and Distribution. ARS scientists at the USDA Subtropical Horticultural Station, Miami, Florida, have introduced and distributed several papaya cultivars and species from 6 countries, and established 21 plantain cultivars for eventual distribution to researchers in the tropics. Over 3,000 species or clones of tropical and subtropical plants are being maintained and seeds of budwood of 7 fruit and tree varieties have been distributed to foreign countries and to U.S. researchers.

22. Improved Tropical Production of Beans and Cowpeas Through Disease and Insect Control. Rust-resistant cultivars of the common edible bean were obtained by ARS scientists at the Mayaguez Institute of Tropical Agriculture in

Puerto Rico. Some of these cultivars have proved resistant to a wide range of rust races endemic to the tropics. Bean cultivars with multiple virus resistance were developed through field cross-pollination. Screening of the International Cowpea Disease Nursery Cultivars resulted in the selection of several having resistance to the highly pathogenic strain of the cowpea mosaic virus present in Puerto Rico.

23. Evaluation of Plantain Varieties and Development of Production Techniques. A detailed survey being conducted throughout Puerto Rico by the University of Puerto Rico under contract to ARS has resulted in the discovery of plantain cultivars producing over 60 fruits per bunch and having a bunch weight of more than 45 pounds. This compares to a current average of 35 fruits per bunch. Through closer planting, fertilization and nematode control, plantain yields per acre in test planting have been increased three-fold.

RESEARCH ON THE USE AND IMPROVEMENT OF SOIL, WATER, AND AIR

Current activities: Research is conducted to improve the management of natural resources, including investigations to improve soil and water management, strip mine reclamation, salinity control, fertilizer efficiency, tillage practices and machines, irrigation and drainage practices, and to determine the relation of soil types and water to plant, animal, and human nutrition. The research includes studies on hydrologic problems of agricultural watersheds and the application of remote sensing techniques in meeting agricultural problems. Research is also conducted on agricultural pollution problems such as protection of plants, animals, and natural resources from harmful effects of soil, water, and air pollutants, and ways to minimize and utilize industry processing wastes of agricultural commodities.

There is a need for land and water resource improvement to maintain and improve the quality of the environment and the natural resource base and to enhance the development of rural communities.

Selected examples of recent progress: A description of these examples follows this index.

Research on Conservation and Use of Land and Water Resources and Maintaining Environmental Quality

1. Conditions Restricting Revegetation of Strip-Mine Spoils are Identified
2. Soil Compaction Caused by Wheel Traffic
3. Soil Nitrates Found to Take New Pathways
4. Linkages Between Soil Nutrients and Health Explained
5. New Scheduling for Irrigation Cuts Costs
6. Water Management Reduced Salt Load in Irrigation Return Flows
7. Pollution Hazards Reduced By Minimum Tillage System
8. Composting Procedure for Sewage Sludge Improved and New Uses Demonstrated
9. Less Costly Disposal of Runoff from Feedlots
10. Roadside Harvest Proven Worthwhile

Research on Watershed Development

11. Universal Soil Loss Equation Adapted for Erosion Control in the Pacific Northwest
12. Global Applications for Remote Sensing of Soil Moisture

Research on Soil and Water Conservation and Development

1. Conditions Restricting Revegetation of Strip-Mine Spoils are Identified. ARS scientists at Mandan, North Dakota, have been identifying conditions restricting plant growth in strip-mine spoils of the Northern Great Plains where mining is increasing rapidly to meet the Nation's energy demands. Current surface mining methods tend to invert natural soil layers. Spoils left on the surface are fine-textured and high in sodium content. These characteristics make the spoils very slowly permeable to water and plants grow poorly, if at all. Instead, water runs off causing erosion. Other properties of spoils in the West that restrict plant growth are excessive clay or sand content, high concentrations of soluble salts, and low fertility. ARS researchers found that phosphorus deficiencies are almost universal at mine sites but can be corrected by fertilization. The spoils are essentially devoid of biologically active nitrogen forms but contain a reservoir of inorganic nitrogen which is usually lost after the spoils have weathered a few years. Scientists are developing improved techniques of replacing topsoil, applying fertilizers and mulches to soil materials, and reestablishing vegetation. The importance to agriculture is in reestablishing productivity of crop and rangelands after mining. The research is of vital interest to the Environmental Protection Agency, the Soil Conservation Service and the Department of Interior, and is partially supported by them.

2. Soil Compaction Caused by Wheel Traffic. Wheel traffic of farm tractors and implements compacted soil to 2-foot depths at Morris, Minnesota, and the compaction persisted over winter in spite of soil freezing to 5-foot depths. Energy consumption to mechanically break up compacted soil is costly since normal tillage operations rarely exceed 12 inches. Field studies are providing guidelines for designing farming practices to reduce wheel-traffic compacted soil and increase crop yield. The complexities of plant response to compaction have been studied. Wheel traffic can drastically alter root-growth patterns. Wheat yields were reduced by 25 percent, but corn and soybeans benefited from a moderate amount of compaction in dry years. Soil compaction also affects herbicide, insecticide, and fertilizer effectiveness. Compaction reduces nodulation of soybean roots. The extent to which this reduces biological nitrogen fixation will be determined.

3. Soil Nitrates Found to Take New Pathways. New findings challenge current belief that nitrates in water-logged soils are changed into gases which then escape into the atmosphere in a process known as denitrification. This process reduces the efficiency with which crops utilize soil and fertilizer nitrogen. Some scientists believe these gases are harmful to the earth's ozone layer. ARS scientists found that only a part of the nitrates were converted to gases, and as much as 50 percent could be changed to ammonia and added to the organic matter of the soil. The proportion of nitrates retained in this manner increases with the supply of easily decomposable plant residues in the soil. This information may lead to more efficient use of fertilizer and reduced pollution hazard.

4. Linkages Between Soil Nutrients and Health Explained. Nutrients in the soil affect the quality of the food that humans and animals eat. Nineteen elements are considered essential to plant, animal, and human health. Information has been compiled to show how these nutrients can move from soil to plants, animals, and people, and be used to produce food crops with better nutritional value. Using soils for food production for many years does not automatically cause deterioration; many infertile soils have been improved through use of modern farming practices. Nor is it

necessarily true that inorganic or chemical fertilizers, as opposed to organic fertilizers, adversely affect soils. Food production systems of the future almost certainly will include combinations of both organic and inorganic fertilizers, with the combination varying for different farms and countries. Agricultural Information Bulletin 378 describing these findings is available from GPO.

5. New Scheduling for Irrigation Cuts Costs. Farmers and ranchers who irrigate sandy soils with center pivot sprinklers can cut annual costs on a typical 150-acre corn field by about $2,100 by following an irrigation schedule developed by ARS scientists in Colorado. These savings are based on increased corn production and cost-savings for nitrogen and electricity. In Nebraska alone, this schedule could be used on about 4 million acres of land previously suitable for only rangeland. The program uses meteorological data to estimate crop needs to make efficient use of water while still maintaining high yields. Irrigators who followed the particular weekly irrigation schedule increased corn yields from 125 to 155 bushels per acre. When they followed the new schedule, irrigators lost only 5 percent of the total irrigation water by deep percolation as compared with 16 percent for systems considered well-managed with high yields. Water moving through the soil carried 60 pounds per acre of nitrogen below the root zone for unscheduled fields whereas irrigation scheduling systems lost only 20 to 30 pounds per acre of nitrogen. This research answers a specific need as expressed by the Great Plains Council.

6. Water Management Reduces Salt Load in Irrigation Return Flows. Carefully controlled and managed irrigation that provides only the water needed by the crop plus a small amount for leaching salts can reduce the adverse effect of salt in rivers associated with irrigation. ARS researchers at the U.S. Salinity Laboratory, Riverside, California, have shown that practices that permit 10 percent of the irrigation water applied to percolate through the soil as drainage more than satisfied most crop needs and prevented salinity damage for a wide range of waters. Irrigators now use 30 percent or more. Such practices significantly lessen the stream salt burden (1.1 ton per acre per year reduction in salt at the Imperial Dam). Applied to about 65,000 acres irrigated in the Wellton-Mohawk District, an ultimate beneficial reduction of 71,000 tons per year of salt could be expected. Thus, irrigation management is a major tool towards accomplishing the goal of enhancing water quality. The research is specifically aimed at reducing the salt load in the lower Colorado River and is of particular interest to the Departments of Interior and State, and the Environmental Protection Agency. The practical feasibility of these findings is currently under study through extensive field experiments in Arizona and Colorado. The required investment in capital and reeducation should compare favorably with alternatives, such as capital and energy-intensive desalting schemes. Additional water demands for development of new energy sources, recently estimated at 874,000 acres per foot per year for the Upper Colorado River Basin, make the opportunity for improved irrigation management particularly timely.

7. Pollution Hazards Reduced by Minimum Tillage System. To reduce pollution hazards from both sediments and farm chemicals, there is a need for improved erosion control in Mississippi. ARS scientists at Oxford, Mississippi, showed that the no-till system for corn, small grains, and soybeans had soil losses to 0.2 tons per acre per year as compared with conventionally-tilled losses of 7.4, 4, and 13 tons per acre per year, respectively. Total losses of nitrogen and phosphorous from no-till soybeans were 4.2 and 2.5 pounds per acre compared with 41.4 and 15.7 pounds per acre from

conventional-tilled soybeans. The no-till system provides a means for reducing erosion and the loss of farm chemicals, thus improving the quality of surface runoff from agriculture. The research was specifically requested by the Soil Conservation Service.

8. Composting Procedure for Sewage Sludge Improved and New Uses Demonstrated. A simple but highly efficient composting technique has been developed where air is drawn through a large pile of mixed sludge and woodchips and then conducted through a second pile consisting of cured compost. The second pile effectively removes gases with objectionable odor. Great reduction in numbers of fecal bacteria indicated that pathogens were probably likewise destroyed during the composting process, even in unfavorably cold or wet weather. Other health-related research suggested that viruses were more effectively removed from solution in soils with somewhat lower acidity than in those with higher acidity. Recent experiments have clearly demonstrated the usefulness of the compost in many situations; e.g., agricultural crops, turf establishment and maintenance, revegetation of strip-mine soil, potting medium for ornamental plants, and the growth of dogweed and tulip poplar trees from seed in the field.

9. Less Costly Disposal of Runoff from Feedlots. New approaches for disposing of runoff from beef cattle feedlots reduce the cost of controlling stream pollution for owners of small and average-sized feedlots. Two approaches to direct disposal of runoff by infiltration on the soil are being studied at Lincoln, Nebraska. A serpentine, or switch-back terrace, disposal system is used on sloping land, and a leveled area surrounded by a low dike is used on nearly level land. Direct-land disposal eliminates the high costs of holding ponds, pumps, and liquid-distribution systems, as well as attendant problems of odor, maintenance, and land application. Direct-land disposal of runoff is practical because runoff from rainfall begins earlier and is larger in quantity on feedlots than that from adjacent cropland. The first runoff from a feedlot (which has the highest content of chemical pollutants) has a high water pollution hazard, but is beneficial to crop and grasslands.

10. Roadside Harvest Proven Worthwhile. Ranchers and farmers who are short of hay or need low-cost forage might consider fertilizing and harvesting forage from along highways and median strips. Studies in Wyoming showed that 80 pounds per acre of nitrogen and 56 pounds per acre of phosphorous produced about 1,762 pounds per acre of forage as compared with about 639 pounds per acre forage harvested from unfertilized plots. More forage was harvested from areas nearest the highway than from those farther away (2,241 vs. 1,306 pounds per acre) because the impervious highway surfaces provided more moisture for forage nearest the highway. There are many advantages of this practice, including: highway scenery is improved for motorists because the fertilizer keeps roadsides greener longer into the summer, harvesting the forage saves county and State highway departments time and money spent mowing the right-of-way, removing this grass allows snow to blow across the road rather than collecting on it, and harvesting the hay also reduces the possibility of fires.

Research on Watershed Development

11. Universal Soil Loss Equation Adapted for Erosion Control in the Pacific Northwest. Sediment from eroding cultivated croplands is the major polluter of surface water in the Pacific Northwest. Much of this sediment is productive topsoil containing plant nutrients. About 8 million acres of cropland are directly affected with losses averaging between 10 to

15 tons per acre per year. Some critical areas lose over 100 tons per acre per year. The urgency to develop improved erosion-control methods has increased because of public mandates for improved water quality. At the request of the Soil Conservation Service, the Universal Soil Loss Equation which was developed to predict erosion in areas with summer precipitation has been adapted to the unique winter precipitation and topographic features of the Pacific Northwest. This equation evaluates and projects the effectiveness of crop-management systems for preserving valuable soil and meeting water-quality standards. Weaknesses in any given system can then be corrected so that the final erosion-control practice used is the best possible.

12. Global Applications for Remote Sensing of Soil Moisture. Applying newly developed techniques to assess soil moisture using aircraft and/or satellites could be of incalculable economic value to global agriculture. These techniques may have equal application to other specialities, including hydrology and civil works. ARS scientists at the U.S. Water Conservation Laboratory, Phoenix, Arizona, are utilizing thermal-infrared radiation to remotely assess soil moisture by using infrared thermometers. Maximum and minimum temperatures of soils are measured from airplanes and the differences in those temperatures are correlated with ground-truth data to determine the water content of the soil under study. The technique is being designed so that it can be used in satellites as well. Assessing soil moisture over large areas could improve our capabilities for managing rangelands, predicting crop yields, and warning of wind erosion hazards. Similar approaches are being tested to relate crop-canopy temperatures with crop water stress and yield. This is a cooperative research effort with National Aeronautics and Space Administration.

RESEARCH ON MARKETING, USE, AND NUTRITIONAL VALUE OF AGRICULTURAL PRODUCTS

Current activities: Research is conducted to develop new and improved foods, feeds, fiber and industrial products and processes utilizing renewable agricultural commodities in order to maintain and expand domestic and foreign markets for farm crops. Research is conducted on marketing of agricultural products. Studies concern the processing, transportation, storage, wholesaling and retailing of products, to reduce the costs of marketing, to maintain product quality, to reduce losses from waste, spoilage, insect infestation, and pollution.

Research is conducted on human nutritional requirements, composition and nutritive value of foods to provide information needed for consumers and for Federal, State and local agencies administering food and nutrition programs.

Research is conducted on problems of human health and safety. Studies concern developing means to insure food and feed supplies and products free from toxic or potentially dangerous residues, harmful chemicals, microorganisms introduced from agricultural sources, and processing operations. The research conducted also includes studies concerning means to control insect pests of man and his belongings; prevent transmission of animal diseases and parasites to man; reduce the hazards to human life resulting from pesticide residues, toxic molds, tobacco, and other causes; and, develop technology for the detection and destruction of illicit growth of narcotic-producing plants.

Research is conducted on consumer services to measure family use of resources, to identify economic problems of families, and to provide information on fabric performance and the use and care of clothing and housefold articles by consumers. Research on housing is conducted to provide knowledge and technology to help

bring about improved designs, material, and construction methods for both low-cost renovation and new construction of rural housing suitable for low-to-moderate income rural residents.

Selected examples of recent progress: A description of these examples follows this index.

Market Efficiency Research

1. Super Slurper Receives New Product Award
2. Major Step Achieved In Controlling Stored-Product Insects
3. Potato Storage Losses Reduced
4. Washable or Dry Cleanable Poly-Retan Garment Leathers Could Open New Markets
5. New Insect Detection Method Developed
6. Starch-Based Plastics Replace Plastics Derived from Petroleum
7. Live Steam Process for Conditioning Pecans Improves Shelling Efficiency and Storage Stability
8. Unitized Handling of Lettuce Results in Savings
9. Bioregulation Enhanced Fruit Quality and Appearance
10. Improved Wool Fabrics Will Help Regain Sales
11. Fast, Accurate Test for Analyzing Forage Quality

Research to Expand Agricultural Exports

12. Fumigation Treatment Developed for Grapefruit

Food and Nutrition Research

13. Getting Good Protein Out of Cottage Cheese Whey
14. New Iron Compound Isolated from Wheat
15. New Process Developed for Recovering Food-Grade Protein from Rice Bran

Research to Improve Human Health and Safety

16. Corn Starch Compound Removes Heavy Metals from Waste Waters
17. Aflatoxin Inactivated in Corn
18. Low-Fat Diets Reduce Blood Pressure in Man

Research on Consumer Services

19. Cotton/Polyester Blend Fabrics Made Flame Resistant
20. Cotton Fabrics Made Germicidal for Prevention of Diseases and Elimination of Perspiration Odors

Market Efficiency Research

Super Slurper Received New Product Award. As a part of the agency research effort on corn, a new product has been developed. Super slurper, a water absorbing starch-compound, developed by Agricultural Research Service scientists, has won Industrial Research magazine's recognition as one of the 100 most significant new products of 1975. Developed at the Northern Regional Research Center (NRRC), Peoria, Illinois, super slurper takes up 1,400 times its weight of distilled water, half of it in 30 seconds. It absorbs as much as 100 times its weight of mineral solutions including hard water and urine.

Seven companies have licensed the USDA patent application and one, General Mills Chemicals, has announced it is offering the new product to other companies in developmental quantities. NRRC has received more than 1,000 requests for experimental samples for trial in soils, disposable diapers, bandages, towelling, kitty litter, and a variety of other applications totalling more than 50.

2. Major Step Achieved In Controlling Stored-Product Insects. Progress was achieved in a new technology for controlling stored-product insects by scientists as they isolated and identified the primary component of the sex pheromone of several Trogoderma beetles. With further research the pheromone may be synthesized and used to attract insects to traps that contain a killing agent such as an insecticide, sticky compound, or disease agent. Traps will be used to monitor or detect the presence of insects in order to selectively apply controls when and where they may be needed. Trogoderma beetles, which include the notorious khapra beetle, are serious pests of stored grain and numerous other foods of either vegetable or animal origin in most parts of the world. The newly discovered pheromone is extremely effective for the primary warehouse pest in California, Trogoderma variabile. Isolation and identification of the pheromone was a joint project of ARS scientists at Madison, Wisconsin, and their colleagues at Syracuse University, New York, and the Max Planck Institute, Seewiesen, Germany.

3. Potato Storage Losses Reduced. One of the biggest problems of stored potatoes, Fusarium dry rot, has been solved in a cooperative effort by an ARS scientist in Orono, Maine, and a scientist at North Carolina State University. Losses caused by this disease have been estimated at $165 million. A treatment with a fungicide - thiabendazole - applied to the potatoes just prior to putting them in storage has reduced losses due to this disease to less than one percent. Clearance of thiabendazole by Environmental Protection Agency in 1975 has allowed about one million hundredweight of Maine potatoes to be treated with this fungicide.

4. Washable or Drycleanable Poly-Retan Garment Leathers Could Open New Markets. Substantial new markets are expected to open up for garment leathers that can be manufactured with a new process developed at the Eastern Regional Research Center, Philadelphia, Pennsylvania. Improved drape, resilience, and stretchability are qualities produced in the new process. The new Poly-Retan leathers are available in drycleanable or washable versions. Industrial interest in Poly-Retan garment leathers is high because of the easy-care properties and other qualities having high consumer appeal. Poly-Retan leather is expected to be competitive with synthetic fabrics and synthetic shoemaking materials that represent a multimillion dollar market. Poly-Retan garment leathers could be made from much of the 3 billion pounds of cattle hides, pigskins, and sheepskins produced annually in the United States. The new process is an economical, one-step operation involving the grafting of selected dyes and other chemicals onto chrome-tanned leather stock. This operation replaces the traditional operations of retanning, fatliquoring, dyeing and finishing.

5. New Insect Detection Method Developed. A new method of detecting insects in foods in processing and marketing channels has been developed at the Stored-Product Insects Research and Development Laboratory, Savannah, Georgia. It is sensitive enough to detect within minutes the presence of even a single insect in a 1,000-gram sample of wheat, flour, packaged mix, or dried fruits. The method uses instrumentation in a manner such that the minute quantities of carbon dioxide (CO_2) generated by the insects

can be detected even in the presence of normal atmospheric CO2. Laboratory tests of prototype systems and a wide variety of foodstuffs (wheat, flour, corn meal, prepared mixes, cocoa powder, candy bars, and dried fruits) have been highly successful. One field test was conducted with an incoming shipload of a new crop of dried Iranian dates as it was moved through the port of Savannah. The test was conducted in cooperation with Agricultural Marketing Service (AMS) and Nabisco, Inc., and results showed that the new insect detection system could be effectively integrated into existing AMS inspection routines. Such a system is now being developed for the Department of Defense to be used for inspecting military subsistence items. Studies are also underway to adapt the system for use by the Food and Drug Administration to replace traditional detection methods that are costly and time-consuming with only limited application.

6. Starch-Based Plastics Replace Plastics Derived from Petroleum. One company is replacing petroleum products with corn starch in making water-soluable laundry bags from plastic film that is 20 percent starch. This first industrial application of techniques developed by Agricultural Research Service chemists saves the company $220,000 a year, conserves petroleum, and provides a biodegradable plastic that does not permanently pollute the environment. The company's use of starch at the rate of 500,000 pounds a year in making starch-polyvinyl alcohol film establishes the economic and technical feasibility of techniques developed at the Northern Regional Research Center, Peoria, Illinois. Plastics containing as much as 60 percent of starch or starch-derived materials can be made by these techniques. Starch-based plastics can be formed into trays, eating utensils, packaging materials, bags and other disposable items. They can be used as thin films for mulching vegetable crops. Most of the 22 million pounds of conventional plastics made every year will not decompose after disposal, and some are visibly accumulating.

7. Live Steam Process for Conditioning Pecans Improves Shelling Efficiency and Storage Stability. Total annual pecan production in the U.S. for the years 1954-1968 averaged 184 million pounds and during this period over 80 percent of the annual production was marketed shelled. The operating efficiency of commercial shelling plants influences the prices farmers receive for pecans and the prices consumers have to pay for them. A major source of economic loss in the industry is the low yield of unbroken nutmeat halves obtained in commercial shelling operations. An ARS-developed improved process for conditioning pecans by subjecting them to live steam for 3 minutes prior to shelling increases yield of halves from 50-70 percent up to 90 percent, reduces process time from 18-24 hours down to 3 minutes, reduces labor and equipment requirements, and significantly extends the storage life of the product. Adoption of this process by industry could result in an estimated savings of $5 million per year.

8. Unitized Handling of Lettuce Results in Savings. Millions of dollars can be saved by growers and shippers of lettuce by "unitizing" handling along with the use of a "new" carton size. ARS scientists at Fresno, California, have shown that lettuce can be unitized in the field and that these intact "units" of 16 cartons each can be mechanically handled through each step in the marketing system. By using a slip sheet for the unit base, rather than a wooden pallet, approximately $2 is saved on each unit; a new carton developed for the system saves about 8 cents over the carton now in use. Since 110 million cartons of Western Iceberg lettuce were shipped to market last year, projected savings amounts to $8 million for cartons alone. With additional savings in handling costs, the new system should

result in delivery of lower priced lettuce to consumers, and also should reduce bruising and loss of quality. Increased efficiencies in the new system would benefit producers, carriers, wholesalers, retailers, and consumers.

9. Bioregulation Enhances Fruit Quality and Appearance. A new concept of fruit, and possibly vegetable, treatment has potential for revolutionizing those fresh market industries by raising the quality and appearance (shelf life) of fruits and vegetables for a longer period of time. The concept of chemically regulating fruit composition and metabolism after it leaves the tree or field has been demonstrated by ARS scientist at Pasadena, California. A number of synthetic bioregulators have been discovered that specifically control pigments that enhance citrus fruit color and increase provitamin A 60 fold. More recently other bioregulator-like agents have been discovered that retard the ripening process in certain fruits. Potential benefits of bioregulation of plant metabolism and composition are considerable. Bioregulatory control of the ripening process of bananas, for instance, should reduce losses of this valuable food, prolong shelf life, reduce refrigeration requirements, a multi-million dollar savings in itself, and allow a longer time for transportation and marketing. Storage temperatures higher than those now used would reduce refrigeration needs and allow reductions in energy use both in storage and in transit.

10. Improved Wool Fabrics Will Help Regain Sales. With processes developed by ARS scientists at the Western Regional Research Center, wool can now be manufactured with two-way stretch, high bulk, and other desirable properties. A simple chemical treatment "sets" wool fibers in whatever condition they are in when treated. Thus, when woven wool or wool blend fabrics are treated in a slack condition, an excellent 2-way stretch woven fabric results. If the fabric is treated under tension, a smooth, firm fabric is produced. Straight fibers, such as mohair and coarser wool, can be treated while in a knitted state, then "unknitted" and rewoven to yield a high bulk, soft textured yarn for re-manufacture into more desirable fabrics. The chemical is cheap, plentiful, and biodegradable and the treatment is compatible with existing mill equipment. The process can be run continuously at less than 5 cents per pound of treated fabric.

11. Fast, Accurate Test for Analyzing Forage Quality. ARS scientists at Beltsville, Maryland, and University Park, Pennsylvania, have developed a new, rapid method for determining the quality of forages. This method could be an important research tool in forage breeding research. A measurement of the reflectance of specific wavelengths of infrared light is utilized to determine the various components of a small sample of ground forage. Preliminary results show excellent correlations with the cellulose, fiber, protein, lignin, digestibility, moisture content and intake (how much the animal will actually eat) of the forage. The analysis of the ground sample takes about 1 minute compared with the present method of analysis which takes several days. The method could revolutionize the analytical procedures for estimating forage quality. It is uniquely adopted to solve plant breeding, management, marketing and nutritional problems through use of computer technology.

Research to Expand Agricultural Exports

12. Fumigation Treatment Developed for Grapefruit Exports. Research by ARS scientists at Miami, Florida, shows that ethylene dibromide is an effective fumigant against immature stages of the Caribbean fruit fly that infects

grapefruit in Florida. The Japanese Government in June 1974 prohibited importation of grapefruit from Florida due to infestations by Caribbean fruit fly larvae. In cooperation with industry, the Miami scientists developed a treatment in which grapefruit are fumigated in cardboard shipping cartons in semi-trailer vans. In these studies over 21,000 grapefruit containing over 100,000 Caribbean fruit fly larvae were fumigated with no fruit fly larvae surviving the treatment. As a result of these experiments the Japanese Government approved resumption of shipments of fumigated grapefruit to Japan and the Florida Citrus Industry shipped over 5 million cartons worth $20 million to Japan during the period from February 10 to May 5, 1975.

Food and Nutrition Research

13. Getting Good Protein Out of Cottage Cheese Whey. A highly nutritious protein recovered from the whey that's left after making cottage cheese is being utilized experimentally to increase the nutritive value of a number of foods. At the same time, use of the whey means that it stays out of our lakes and streams, where it otherwise would be dumped as a troublesome waste product. Tests have shown that incorporating the protein into macaroni at levels of only 8 3/4 percent of weight of the formulation, can raise the protein value of the macaroni equal to milk protein (casein). Moreover, the protein-fortified macaroni can be produced on a commercial scale with no change in the traditional manufacturing process and no change in taste or flavor. A projected 1975 consumption in the United States of nearly 2 billion pounds of all pasta products, including macaroni, gives some idea of the potential market for whey protein. The food industry is interested in the process because the whey proteins could enhance the nutritional value of many processed foods, including cereals and snacks. Currently, only 42 percent of the 32 billion pounds of fluid whey produced annually in the United States is used. Cottage cheese whey comprises 20 percent of the total and is even less utilized. The process of recovering the protein from the whey involves a straightforward, economical steam-injection step that yields an easily handled protein curd.

14. New Iron Compound Isolated from Wheat. A unique new iron compound known as monoferric phytate was recently isolated from wheat bran by human nutritionists at Beltsville, Md. This is the first time this compound has been found as a natural constituent in foods. Further study of this material, which shows excellent biological availability and is the major iron component in wheat, will lead to better understanding of how humans utilize it in cereals. The monoferric phytate was found in studies on biological utilization of iron in foods. Foods rich in iron are important for good health. Iron's importance is evident from statistics showing that 10 to 15 percent of certain population groups are anemic or have low iron reserves in their bodies. In work on rats, monoferric phytate was found equal to another iron compound known as ferrous ammonium sulfate in its ability to support formation of red blood cells. Some of the physical and chemical characteristics of this new iron compound may explain why rats utilize it so well. It is readily soluble in water in contrast with poorly utilized forms of iron, like the higher iron phytates which tend to be insoluble.

15. New Progress Developed for Recovering Food-Grade Protein from Rice Bran. ARS scientists at Berkeley, California, developed the technology for recovering and concentrating the highly nutritious food-grade protein from rice bran. In addition to rice bran's protein content (possibly the highest quality in any enriched cereal protein), it is also rich in fat,

starch, vitamins, and minerals. This source of protein is available in areas frequently suffering food shortages. Bran is the outer covering of rice which is removed during milling to produce white rice. Bran is usually fed to cattle or discarded because of its high fiber content, tough hull fragments, and oil that quickly becomes rancid. The new process eliminates undesirable components that still can be used in animal feeds and produces a stable and nutritious protein concentrate and high protein flour. Wheat flour bread can be made containing 15 to 20 percent of these rice products. It is estimated that enough protein to satisfy the requirements of 245 million people could be recovered from rice.

Research to Improve Human Health and Safety

16. Corn Starch Compound Removes Heavy Metals from Waste-Waters. A corn starch compound developed by ARS scientists offers industry a new way to recover heavy metals dissolved in waste-waters. Metals recovered with this material are sufficiently concentrated to make practical the recycling of the more expensive ones. ARS chemists at the Northern Regional Research Center (NRRC) have responded to more than 1,100 industrial requests in 12 months since they announced the new development. Two companies are supplying cross-linked starch on request to firms for making and trying the compound. In NRRC chemists are working under a grant from the EPA, with wastes from brass mills, lead battery plants and copper etching plants to further advance the new technology. Recycling metals at plants where they are used reduces the danger of toxic levels in public water supplies and city sewage sludge and conserves them as limited resources.

17. Aflatoxin Inactivated in Corn. A toxin produced by a mold can be inactivated in corn by treating the corn with ammonia gas or liquid. Aflatoxin, named for the mold that sometimes produces it, Aspergillus flavus, can cause cancer in animals and is a suspected carcinogen to humans. Corn that contained aflatoxin was treated with ammonia in the laboratory at the Agricultural Research Service's Northern Regional Research Center, Peoria, Illinois, then chemically analyzed and fed. Both chemical assay and feeding tests with duckling, chickens and trout indicated the aflatoxin had been inactivated. The laboratory scale studies were repeated in grain storage bins made of corrugated steel typical of those used on the farm but specially sealed. This farm-scale ammoniated corn is being fed hogs and broiler chickens in trials designed to look for unexpected side effects, and to determine whether the ammoniation process is acceptable to the Food and Drug Administration (FDA) or a means of utilizing the corn as feed for market animals. A FDA approved method would eliminate the waste of destroying FDA-condemned corn and tend to stabilize markets and attitudes that can fluctuate wildly with reports of aflatoxin during corn harvesting.

18. Low-Fat Diets Reduce Blood Pressure in Man. Nutritionists estimate that the average American diet contains 45 percent fat calories. A number of medical groups have recommended a reduction to 35 percent. Scientists in the Nutrition Institute at the Beltsville Agricultural Research Center conducted dietary studies to show that such a change in the American diet could easily be made using foods commonly available at grocery stores. A low-fat diet of 25 percent fat calories for 40 days, followed by 35 percent fat calories for an additional 40 days, was fed to 10 men and 11 women volunteers in the 40 to 60 age group. Results showed that a 15 percent reduction in blood cholesterol was accompanied by a 15 percent drop in systolic blood pressure. Furthermore, the volunteers received about twice as much polyunsaturated fat (linoleic acid) in the 25 percent fat calorie diets and three times as much in the 35 percent fat calorie

diets as they were accustomed to in their normal diets. This may also have been a factor in reducing blood pressure since recent evidence from other laboratories indicates chemicals that regulate blood pressure are synthesized from linoleic acid in the kidney. These reduced blood pressures were maintained throughout the study period. When the volunteers went back to their normal diets, however, blood pressure rose to pre-study levels.

Research on Consumer Services

19. Cotton/Polyester Blend Fabrics Made Flame Resistant. Cotton/polyester blend fabrics are used extensively in wearing apparel. The Southern Regional Research Center has developed a flame-retardant material that does not adversely affect fabric quality. The blended fabrics treated with the material (Thpc-urea-PVB-PVC) passed the Department of Commerce flame test after 50 laundry cycles. The fabrics retain 100 percent and 55 percent of their breaking and tearing strengths, respectively. Two companies and four finishing mills are involved in commercializing this process. About 9 million pounds of this chemical could be needed to impart durable flame resistance to about 280 million linear yards of cotton/polyester fabrics per year.

20. Cotton Fabrics Made Germicidal for Prevention of Diseases and Elimination of Perspiration Odors. A new method has been discovered by ARS researchers for making cotton bacteriocidal. Treated fabrics have been produced that show high resistance to certain infectious bacteria and also to bacteria that cause unpleasant odors in human perspiration absorbed in clothing. The chemicals used in this treatment are inexpensive materials which, by themselves, are non-durable and only moderately effective. When applied together, however, they form a novel, colorless, highly bacteriocidal complex. Fabrics treated with a water solution of the complex and heated to dryness retain their original strength, suppleness, porosity and whiteness. The germicidal complex is deposited as a film on the surface of the cotton fibers and is durable to 30 to 50 home-type laundering cycles. Germicidal cotton should prove useful in hospital bedding and bedclothes, bandages, sutures and surgical dressings for use in preventing infection, and in underwear, stockings and shoe linings, where odor suppression is desirable. In certain uses, such as in diapers, sanitary napkins, and socks, both the prevention of skin diseases or infection, and the elimination of odor may be effected. This discovery has great potential benefits for institutional and consumer application.

Status of Construction Projects as of December, 1975

Status of research facilities authorized in prior years, and reported as uncompleted in the 1976 Explanatory Notes, is as follows:

Note: (Design criteria provided by ARS to specify the program requirements and form the basis for negotiation of architect-engineer contracts. Diagrammatic drawings provide the basis for the first review of the architect's design. Tentative drawings are provided by the architect for firming up cost estimates and a basis for developing the completed, and final working drawings).

Location and Purpose	Funds Provided			
	Year		Amount	
California, Albany				
Wool utilization research.	1968	Plans	$50,000 a/	Final working drawings completed in May 1970.
California, Riverside				
Soil and water conservation research.	1968	Plans	50,000 a/	Final working drawings completed in July 1970.
Colorado, Akron				
Soil and water conservation research.	1970	Plans	50,000 b/	Final working drawings completed in June 1973.
	1973	Construction ..	750,000	Construction contract awarded in December
		Total	800,000 c/	1974. Completion of construction is expected in the third quarter of fiscal year 1976.
Louisiana, Baton Rouge				
Soil and water conservation research.	1971	Plans	80,000	Criteria being revised to meet new program requirements.
Maryland, Beltsville				
Electrical substation and central incinerator.	1970	Construction ..	525,000 d/	Electrical substation completed in October 1972. Incinerator completed in November 1975.
Maryland, Beltsville				
Sewage treatment facilities.	1975	Construction	1,400,000 d/ e/	Final working drawings completed in November, 1975. Construction contract for the East Waste Water Treatment Plant is expected to be awarded in the second quarter of fiscal year 1976.

Status of Construction Projects as of December, 1975 - Cont.

Location and Purpose	Funds Provided Year		Amount	
Nebraska, Clay Center				
Meat animal research (Phase II).	1968	Plans	250,000	Construction contract awarded in October 1975. Construction expected to be completed in the fourth quarter of fiscal year 1977.
	1975	Construction	5,020,000	
		Total	5,270,000	
New York, Ithaca				
Soil and water conservation research.	1968	Plans	40,000 a/f/	Planning has not been scheduled.
New York, Plum Island				
Additional animal and laboratory facilities.	1973	Plans	250,000	Architect-engineer contract awarded October 1973. Final working drawings completed in December, 1975.
New York, Plum Island				
Air pollution abatement and sewage treatment facilities.	1973	Plans and Construction	1,060,000	Construction contract for incinerator modification awarded in July 1975. Construction is expected to be completed in the third quarter of fiscal year 1976. Design completed for the sewage treatment facilities. Construction contract expected to be awarded in the third quarter of fiscal year 1976. Construction is expected to be completed in the third quarter of fiscal year 1977.
	1976	Construction	2,600,000	
		Total	3,660,000	
Texas, Temple				
Grassland and forage research.	1968	Plans	150,000	Initial construction completed in February 1974. Architect-engineer contract for additional construction awarded in November 1974. Final working drawings expected to be completed in third quarter of fiscal year 1976.
	1971	Construction	1,500,000	
	1973	Construction	500,000	
		Total	2,150,000	

Status of Construction Projects as of December, 1975 - Cont.

Location and Purpose	Funds Provided Year		Amount	
North Dakota, Grand Forks				
Human nutrition research.	1976	Plans	225,000	Pursuant to Section 1012 of Public Law 93-344, funds for this project have been recommended for recission.
West Virginia, Beckley				
Soil and water conservation research.	1972	Plans	70,000	Project being redesigned to meet available funds. Design criteria is completed. Architect-engineer contract award expected in the third quarter of fiscal year 1976.
	1973	Construction	700,000 f/	
		Total	770,000	
West Virginia, Kearneysville				
Fruit crop research.	1973	Plans	200,000	Architect-engineer contract awarded in November 1973. Final working drawings completed in November 1975. Construction contract expected to be awarded in the fourth quarter of fiscal year 1976.
	1976	Construction	7,570,000	
		Total	7,770,000	

a/ Funds provided from the Contingency Research Fund.

b/ Since $50,000 appropriated in 1970 for planning a Soil-Water-Plant Research Laboratory, Ithaca, New York, and Soil and Water Research Laboratory, Akron, Colorado, was insufficient to plan both of these facilities, the full amount was used at Akron, Colorado.

c/ Due to cost escalation, an additional $100,000 has been reprogrammed from unspent balances of completed construction projects for construction of the Akron, Colorado, facility.

d/ Planning funds were not appropriated separately but are included in the funds appropriated for construction.

e/ In addition, Department of Treasury will provide $100,000 toward costs incurred in completing the project.

f/ Due to cost escalation, funds for the Ithaca, New York, project have been redirected to Beckley, West Virginia, to provide sufficient funds to construct the facility.

CONTINGENCY RESEARCH FUND

The Contingency Research Fund, established by Congress in fiscal year 1962, is designed to provide a ready source of funds to meet unforeseen and immediate research needs. Releases from the funds are generally made in situations where an emergency exists, or for special needs such as an unexpected scientific "breakthrough", or for new diseases or pest problems where it appears inadvisable to wait for consideration of a request for funds for the project in the regular budget process. In allocating funds, the procedure ordinarily is to make no commitments for allocations from the fund beyond the current year.

In fiscal year 1975, releases from the Contingency Research Fund were made for the following purposes:

	1975 Obligations
Animal Production Efficiency Research:	
Repair and refurbish marine vessel to provide required water transportation at PIADC.....	$30,731
Plant Production Efficiency Research:	
Food increasing potential of brassins.....	73,705
Support of viroid research at the Plant Protection Institute, BARC.....	90,314
Determination of changes in corn rust fungi and evaluation of corn genotypes:	
Agreement with Mississippi State.....	25,000
ARS corn research group.....	3,660
Witchweed.....	50,000
Develop optimum method for sterilizing bollweevils by Co dose fractionation.....	18,275
Quality assurance in honey to retain markets and insure adequate crop pollination.....	60,253
Control of Heliothis Zea (corn earworm).....	4,400
Development of integrated management of corn earworm....	20,826
Symbiotic nitrogen fixation in tropical grass species...	30,118
Formulation and field testing of tobacco budworm sex pheromone.....	42,502
Stripe rust of wheat.....	10,314
Determination of chemical composition of corn for genetic variability as basis for increasing nutritive value.....	3,427
Research on the oat cyst nematode.....	20,000

	1975 Obligations
Development of alternative insecticides for resistant tobacco budworm on cotton.....	5,041
Synthesis, characterization, and stabilization of attractant chemicals for bioassay and field testing against corn earworm (Heliothis Zea).....	20,000
Rapid sterilization of bollweevils by vacuum fumigation with the chemosterilant hempa.....	20,003
Spectrophotometric prediction of forage quality.....	49,000
Foreign exploration for lygus bug control agents....	20,000
Research on Conservation and Use of Land and Water Resources and Protecting Environmental Quality	
Increasing irrigation efficiency in Wellton-Mohawk District of Arizona.....	40,891
Feasibility study for fertilizing plants through leaves or bark.....	1,625
Development of alternative insecticides for resistant tobacco budworm on cotton.....	13,963
Research on Watershed Development	
Development of alternative insecticides for resistant tobacco budworm on cotton.....	3,873
Marketing Efficiency Research	
Treatment for plant pests of quarantine importance (Caribbean Fruit Fly).....	87,164
Prototype evaluation of new energy-saving caustic peeling process for potatoes and other vegetables.	7,504
Equip a protein and amino acid analytical laboratory at Manhattan, Kansas.....	25,547
Equipment for improving packaging and shipment of agricultural products.....	49,970
Beef carcass studies - determinants of beef carcass quality.....	65,000
Research to Improve Human Health and Safety	
Toxicological evaluation of aflatoxin-contaminated corn treated with ammonia:	
Poultry feeding studies at Clemson Univ.....	33,200
Swine feeding studies at Univ. of Georgia.....	33,000
Total, 1975 Obligations.....	959,306
Unobligated balance.....	40,694
Total available 1975 Contingency Research Fund.....	1,000,000

Current activities. As of December, 1975 a total of $381,000 has been approved for release from the Contingency Research Fund in F.Y. 1976.

	1976 Estimated Obligations
Animal Production Efficiency Research:	
Control of Alfombrilla (Drymaria arenariodides H.B.K.)	$ 2,500
Research to determine the sources of infection and potential methods of controlling ornithosis outbreaks in turkeys	40,000
Plant Production Efficiency Research	
Control of Alfombrilla (Drymaria arenariodides H.B.K.)	36,000
Implementation of management program for cotton insects utilizing Heliothis resistant varieties	25,000
Develop methods for control of the peachtree borer and the lesser peachtree borer	10,000
Research to prevent the Mediterranean fruit fly from entering Mexico and U.S.A.	75,000
Screen ARS basic collection of pea accessions for presence of pea seed-borne mosaic virus	12,500
Effects of increased ultraviolet radiation on agricultural production	50,000
Effect of resistant corn on the biology of the Southwestern corn borer	15,000
Eradication of horn flies, Haematobia irritana, from Molokai, Hawaii	25,000
Research on Conservation and Use of Land and Water Resources and Protecting Environmental Quality:	
Develop methods to estimate soil water content, evapotranspiration, and crop yields using thermal parameters	30,000
Marketing Efficiency Research	
Feasibility study for using solar energy to dry corn	10,000
Determination of beef carcass quality	10,000
Controlling tobacco insects on farm-stored tobacco	10,000
Research on Human Nutrition	
Survey of home canning practices	30,000
Total, 1976 approved for release from the Contingency Research Fund	381,000
Balance to be allocated prior to June 30, 1976	619,000
Total available, 1976 Contingency Research Fund	1,000,000

STATEMENT OF OBLIGATIONS AND MAN-YEARS

BY LOCATION

LOCATION	Actual 1975		Estimated 1976		Estimated 1977	
	Dollars	Man-Years	Dollars	Man-Years	Dollars	Man-Years
ALABAMA, Auburn.....	1,148,219	55	1,231,600	53	1,423,200	53
ALASKA, Palmer.....	432,536	10	468,900	16	472,700	16
ARIZONA						
Flagstaff.....	125,097	5	147,100	7	148,700	7
Mesa.....	149,394	8	162,400	7	164,500	7
Phoenix.....	2,488,564	119	2,686,300	104	2,805,100	104
Tucson.....	2,057,115	88	2,066,300	90	2,091,500	90
Total.....	4,820,170	220	5,062,100	208	5,209,800	208
ARKANSAS, Stuttgart.....	113,387	2	164,800	2	165,800	2
CALIFORNIA						
Albany.....	10,616,709	435	11,609,400	444	11,762,800	444
Brawley.....	628,708	32	683,300	37	693,100	37
Chico.....						
Davis.....	517,861	15	458,500	14	508,000	14
Fresno.....	1,489,599	59	1,510,300	58	1,573,300	58
Indio.....	176,164	11	209,200	11	212,700	11
La Jolla.....						
Pasadena.....	518,416	16	472,900	16	480,700	16
Riverside.....	1,708,789	63	1,805,200	69	1,870,500	69
Salinas.....	688,357	32	715,300	36	724,300	36
Shafter.....	581,017	26	564,900	23	572,800	23
Total.....	16,925,620	689	18,029,000	708	18,398,200	708
COLORADO						
Akron.....	198,703	9	195,800	8	198,700	8
Denver.....	1,047,493	42	1,124,900	44	1,135,400	44
Fort Collins.....	1,949,782	77	2,370,500	98	2,412,000	98
Total.....	3,195,978	128	3,691,200	150	3,746,100	150
DISTRICT OF COLUMBIA						
Program.....	1,231,195	75	1,295,400	78	1,491,500	78
Headquarters						
Agency Management Svcs...	18,801,840	541	21,890,600	544	22,099,200	544
Centrally Finance Progs..	652,437	5	7,663,500	5	12,834,000 a/	5
Subtotal.....	19,454,277	546	29,554,100	549	34,933,200 a/	549
Total.....	20,685,472	621	30,849,500	627	36,424,700	627
DELAWARE						
Georgetown.....	251,973	11	193,200	8	238,700	8
Newark.....	258,014	12	284,300	13	287,000	13
Total.....	509,987	23	477,500	21	525,700	21

a/ Includes $2,314,800 of budget increases (amounts and locations to be determined based on available scientific expertise).

STATEMENT OF OBLIGATIONS AND MAN-YEARS

BY LOCATION

LOCATION	Actual 1975		Estimated 1976		Estimated 1977	
	Dollars	Man-Years	Dollars	Man-Years	Dollars	Man-Years
FLORIDA						
Belle Glade	141,321	7	145,200	6	146,300	6
Bradenton	42,319	1	36,800	1	37,200	1
Brooksville	179,617	3	171,900	3	172,900	3
Canal Point	312,911	16	342,200	15	345,900	15
Fort Lauderdale	69,611	2	72,700	2	73,500	2
Gainesville	3,207,387	131	3,590,600	136	3,959,400	136
Lake Alfred	92,398	4	96,900	4	98,200	4
Miami	527,871	26	554,800	21	610,800	21
Orlando	1,538,989	74	1,589,700	76	1,696,000	76
Winter Haven	514,790	24	543,200	24	550,100	24
Total	6,627,214	288	7,144,000	288	7,690,300	288
GEORGIA						
Athens	4,813,617	225	5,574,800	241	5,811,600	241
Byron	1,062,009	56	1,235,500	60	1,251,000	60
Dawson	460,180	24	495,000	25	501,000	25
Experiment	127,937	4	216,100	7	217,600	7
Savannah	1,485,954	76	1,569,600	77	1,609,000	77
Tifton	2,332,961	111	2,624,500	103	2,783,900	103
Watkinsville	787,266	35	763,400	35	774,100	35
Total	11,069,924	531	12,478,900	548	12,948,500	548
HAWAII						
Hilo	179,005	10	241,000	11	244,300	11
Honolulu	816,663	28	775,000	31	782,900	31
Total	995,668	38	1,016,000	42	1,027,200	42
IDAHO						
Aberdeen	158,521	5	214,100	6	259,500	6
Boise	442,596	20	464,500	18	471,400	18
Dubois	639,113	17	555,200	19	692,800	19
Twin Falls	1,060,153	52	1,128,600	52	1,188,600	52
Total	2,300,383	94	2,362,400	95	2,612,300	95
ILLINOIS						
Chicago	101,133	3	124,800	4	125,900	4
Peoria	10,606,759	464	11,567,500	474	11,156,200	474
Urbana	1,065,929	44	1,326,500	44	1,408,000	44
Total	11,773,821	511	13,018,800	522	12,690,100	522
INDIANA						
Lafayette	853,603	31	1,132,000	35	1,351,600	35
Vincennes	185,721	10	199,600	7	201,400	7
Total	1,039,324	41	1,331,600	42	1,553,000	42
IOWA						
Ames	6,467,598	296	7,968,300	319	8,169,200	319
Ankeny	246,024	11	343,300	13	346,200	13
Total	6,713,622	307	8,311,600	332	8,515,400	332

STATEMENT OF OBLIGATIONS AND MAN-YEARS

BY LOCATION

LOCATION	Actual 1975		Estimated 1976		Estimated 1977	
	Dollars	Man-Years	Dollars	Man-Years	Dollars	Man-Years
KANSAS, Manhattan	1,900,221	74	2,146,600	79	2,385,700	79
KENTUCKY, Lexington	552,107	28	613,400	30	621,300	30
LOUISIANA						
Baton Rouge	821,042	41	884,900	44	893,500	44
Crowley	43,920	2	44,300	2	44,900	2
Houma	616,335	28	678,900	30	686,200	30
Jeanerette	115,902	4	114,400	4	115,100	4
Lake Charles	158,976	7	166,300	7	168,500	7
New Orleans	12,513,830	485	12,617,000	492	12,624,400	492
Shreveport	5,350	--	--	--	--	--
Total	14,275,355	567	14,505,800	579	14,532,600	579
MAINE, Orono	363,621	13	418,000	14	421,700	14
MARYLAND						
Beltsville	36,355,813	1,642	40,391,000	1,717	40,949,100	1,717
College Park	60,532	4	--	--	--	--
Frederick	758,742	25	1,316,900	26	1,388,600	26
Glenn Dale	198,564	12	242,700	12	246,700	12
Hyattsville	1,472,991	72	3,133,800	103	3,156,200	103
Total	38,846,642	1,755	45,084,400	1,858	45,740,600	1,858
MICHIGAN, East Lansing	1,492,269	64	1,671,300	72	1,784,100	72
MINNESOTA						
East Grand Forks	245,360	10	275,000	10	279,000	10
Minneapolis	118,105	4	128,600	4	129,900	4
Morris	709,674	39	748,300	40	761,400	40
St. Paul	915,005	34	996,500	35	1,113,900	35
Total	1,988,144	87	2,148,400	89	2,284,200	89
MISSISSIPPI						
Gulfport	149,315	8	155,600	8	157,500	8
Meridian	195,385	11	201,900	13	290,900	13
Oxford	1,266,554	55	1,364,300	54	1,379,000	54
Poplarville	76,566	3	69,600	3	70,400	3
Mississippi State	2,192,610	94	2,682,800	96	2,708,200	96
Stoneville	3,753,404	173	3,968,000	176	4,005,900	176
Total	7,633,834	344	8,442,200	350	8,611,900	350
MISSOURI, Columbia	1,993,307	86	2,192,400	93	2,217,800	93
MONTANA						
Bozeman	490,672	17	509,500	18	515,300	18
Miles City	404,936	6	602,200	10	605,400	10
Sidney	549,303	26	608,200	29	659,400	29
Total	1,444,911	49	1,719,900	57	1,780,100	57

STATEMENT OF OBLIGATIONS AND MAN-YEARS

BY LOCATION

LOCATION	Actual 1975		Estimated 1976		Estimated 1977	
	Dollars	Man-Years	Dollars	Man-Years	Dollars	Man-Years
NEBRASKA						
Clay Center	3,675,024	46	4,838,500	56	5,019,800	56
Lincoln	951,416	34	999,900	32	1,010,500	32
Total	4,626,440	80	5,838,400	88	6,030,300	88
NEVADA, Reno	280,997	11	281,000	12	371,600	12
NEW JERSEY						
Belle Meade						
New Brunswick	195,020	8	231,900	8	233,900	8
Total						
NEW MEXICO						
Albuquerque	216,918	9	219,900	8	223,000	8
Las Cruces	612,215	28	770,700	30	776,600	30
Santa Rosa	---	--	---	--	---	--
Total	829,133	37	990,600	38	999,600	38
NEW YORK						
Geneva	116,589	4	150,000	4	151,300	4
Ithaca	1,241,080	46	1,355,000	60	1,585,200	60
Plum Island	6,543,385	314	7,753,300	319	8,397,300	319
Total	7,901,054	364	9,258,300	383	10,133,800	383
NORTH CAROLINA						
Oxford	729,166	39	809,300	36	845,100	36
Raleigh	1,323,393	47	1,795,500	54	2,090,300	54
Total	2,052,559	86	2,604,800	90	2,935,400	90
NORTH DAKOTA						
Fargo	2,851,355	126	3,298,600	124	3,397,000	124
Grand Forks	1,210,302	18	1,364,700	35	1,370,200	35
Mandan	988,480	44	1,168,500	52	1,187,500	52
Total	5,050,137	188	5,831,800	211	5,954,700	211
OHIO						
Coschocton	388,284	18	574,900	23	584,600	23
Delaware	333,088	14	373,000	15	379,200	15
Wooster	720,113	32	782,000	33	790,300	33
Total	1,441,485	64	1,729,900	71	1,754,100	71
OKLAHOMA						
Chickasha	635,423	39	651,500	34	711,400	34
Durant	488,394	25	544,700	21	550,600	21
El Reno	168,446	4	373,300	16	374,500	16
Stillwater	516,052	21	610,900	21	686,100	21
Woodward	227,897	15	300,100	13	303,100	13
Total	2,036,212	104	2,480,500	105	2,625,700	105

STATEMENT OF OBLIGATIONS AND MAN-YEARS

BY LOCATION

LOCATION	Actual 1975		Estimated 1976		Estimated 1977	
	Dollars	Man-Years	Dollars	Man-Years	Dollars	Man Years
OREGON						
Burns	83,886	2	74,100	2	75,000	2
Corvallis	977,913	39	964,800	36	1,026,500	36
Pendleton	539,271	8	542,700	19	545,800	19
Total	1,601,070	49	1,581,600	57	1,647,300	57
PENNSYLVANIA						
University Park	971,326	40	1,264,700	49	1,320,600	49
Wyndmoor	7,583,798	320	8,044,000	348	7,231,300	348
Total	8,555,124	360	9,308,700	397	8,551,900	397
SOUTH CAROLINA						
Charleston	638,410	35	687,600	34	741,700	34
Clemson	835,320	35	952,200	35	965,100	35
Florence	673,869	32	733,900	32	743,400	32
Total	2,147,599	102	2,373,700	101	2,450,200	101
SOUTH DAKOTA, Brookings-Madison	747,303	37	850,500	36	920,600	36
TENNESSEE						
Greenville	126,652	6	242,400	13	244,000	13
Jackson	63,057	3	71,400	3	72,100	3
Knoxville	605,541	27	789,600	30	796,500	30
Lewisburg	85,166	4	83,500	4	84,400	4
Total	880,416	40	1,186,900	50	1,197,000	50
TEXAS						
Austin						
Beaumont	247,079	12	264,700	12	329,200	12
Big Spring	105,242	5	137,500	5	182,500	5
Brownsville	909,678	49	896,700	44	907,800	44
Brownwood	142,230	7	326,500	10	354,400	10
Bushland	693,103	31	842,300	31	852,000	31
College Station	3,655,706	171	3,970,500	159	4,081,500	159
El Paso	44,538	2	45,700	3	46,300	3
Kerrville	1,209,729	61	1,218,000	55	1,235,300	55
Lubbock	576,809	25	611,100	26	618,800	26
Mission	373,071	17	497,300	20	501,500	20
Temple	566,652	24	1,392,800	43	1,399,700	43
Vernon (Chillicothe)	120,094	4	204,000	4	205,000	4
Weslaco	1,890,920	101	2,007,100	97	2,232,400	97
Total	10,534,851	509	12,414,200	509	12,946,400	509
UTAH, Logan	1,263,667	52	1,425,100	58	1,551,600	58
VERMONT, Burlington	228,034	10	---	--	--	--

STATEMENT OF OBLIGATIONS AND MAN-YEARS

BY LOCATION

LOCATION	Actual 1975		Estimated 1976		Estimated 1977	
	Dollars	Man-Years	Dollars	Man-Years	Dollars	Man-Years
VIRGINIA						
Blacksburg	104,172	5	101,700	5	102,400	5
Richmond	112,310	5	129,400	5	130,600	5
Suffolk (Holland)	273,427	12	290,900	12	295,000	12
Total	489,909	22	522,000	22	528,000	22
WASHINGTON						
Prosser	754,051	34	826,300	36	837,600	36
Pullman	1,238,356	56	1,553,900	65	1,642,900	65
Puyallup	37,712	2	-0-	0	- -	- -
Wenatchee	531,747	22	569,300	22	575,900	22
Yakima	1,046,778	49	1,046,100	42	1,062,000	42
Total	3,608,644	163	3,995,600	165	4,118,400	165
WEST VIRGINIA, Morgantown	188,455	7	384,300	14	386,800	14
WISCONSIN, Madison	965,410	44	1,176,000	48	1,187,600	48
WYOMING						
Cheyenne	198,125	10	349,100	13	351,800	13
Laramie	103,601	5	284,500	10	286,100	10
Total	301,726	15	633,600	23	637,900	23
PUERTO RICO						
Mayaguez	616,244	39	608,800	40	617,100	40
Rio Piedras	191,812	7	289,600	12	291,400	12
Total	808,056	46	898,400	52	908,500	52
VIRGIN ISLANDS, St. Croix	141,828	9	183,000	11	184,400	11
MEXICO						
Iguala	1,217	--	--			
Tuxtla Gutierrex	--	--	178,100	2	178,100	2
OTHER FOREIGN COUNTRIES						
Argentina	5,881	--	7,900	- -	8,000	- -
El Salvadore	188,096	1	181,400	2	184,300	2
France, Paris	221,674	8	226,900	8	230,600	8
India, New Delhi	7,000	- -	- -	- -	- -	- -
Italy, Rome	121,131	5	125,600	5	127,500	5
Kenya	78,325	2	88,600	2	90,000	2
Netherlands, Rotterdam	195,942	4	229,800	5	233,500	5
Pakistan	57,761	1	52,200	2	53,000	2
Thailand	70,937	1	57,400	2	58,300	2
Total	946,747	22	969,800	26	985,200	26

STATEMENT OF OBLIGATIONS AND MAN-YEARS

BY LOCATION

LOCATION	Actual 1975		Estimated 1976		Estimated 1977	
	Dollars	Man-Years	Dollars	Man-Years	Dollars	Man-Years
Construction of facilities...	6,420,000	- -	10,395,000	- -	- -	- -
Contingency research fund....	a/	- -	1,000,000	- -	1,000,000	- -
Unobligated balance.....	1,365,171	- -	- -	- -	- -	- -
Total, available or estimate.	224,450,000	9,054	263,304,000	9,474	264,202,000	9,474

a/ Obligations of $959,306 of the $1,000,000 appropriated in 1974 are included above.

(b) Scientific Activities Overseas (Special Foreign Currency Program)

Appropriation Act, 1976	$ 7,500,000
Budget Estimate, 1977	10,000,000
Increase	+2,500,000

PROJECT STATEMENT
(on basis of appropriation)

Project	1975 Actual	1976 Estimate	Increase or Decrease	1977 Estimate
1. Market development research, Sec. 104(b)(1)	$ 700,000	$1,000,000	$ 500,000	$ 1,500,000
2. Agricultural and forestry research Sec. 104(b)(3)	3,850,000	5,850,000	+1,850,000	7,700,000
3. Translation and dissemination of scientific publications, Sec. 104(b)(3)	450,000	650,000	+150,000	800,000
Total, appropriation	5,000,000	7,500,000	+2,500,000	10,000,000

The following statement reflects carryover into succeeding years of actual or estimated prior year balances and shows total actual or planned obligations.

PROJECT STATEMENT
(on basis of available funds)

Project	1975 Actual	1976 Estimate	Increase or Decrease	1977 Estimate
1. Market development research, Sec. 104(b)(1)	$ 349,211	$1,000,000	$ +500,000	$ 1,500,000
2. Agricultural and forestry research, Sec. 104(b)(3)	6,263,620	6,824,309	+875,691	7,700,000
3. Translation and dissemination of scientific publications Sec. 104(b)(3)	- -	1,101,702	-301,702	800,000
Total, obligations	6,612,831	8,926,011	+1,073,989	10,000,000
Unobligated balance start of year	-3,038,842	-1,426,011	+1,426,011	- -
Unobligated balance end of year	+1,426,011	- -	- -	- -
Total, available or estimate	5,000,000	7,500,000	+2,500,000	10,000,000

EXPLANATION OF PROGRAM

Foreign currencies which the Treasury Department determines to be excess to the normal requirements of the United States are used for expenses of carrying out programs of the Department of Agriculture as authorized by law and described under sections 104(b) (1) and 104(b) (3) of the Agricultural Trade Development and Assistance Act of 1954, as amended. Research is carried on through agreements negotiated with research institutions and organizations in foreign countries. The research must be of importance to American agriculture. It serves to preserve and expand existing markets and develop new ones for agricultural commodities. It provides for research supplementary to domestic programs on problems of farm, marketing, utilization, agricultural economics and human nutrition, and makes possible the conduct of research on exotic insect pests and diseases of plants and animals which could not be done in the United States. Specialized projects provide for the translation and dissemination of foreign language scientific publications. The increase proposed in 1977 would be used to purchase foreign currencies in those countries determined to be excess to the normal requirements of the United States to expand overseas research of value to U.S. agriculture. Total estimated cost in U.S dollars (charged to regular appropriations) for program direction and supervision of projects in 1977 is $725 thousand.

JUSTIFICATION OF INCREASE

SPECIAL FOREIGN CURRENCY RESEARCH.....$2,500,000

Objective: Expand research to benefit U.S. agriculture, increase markets for U.S. agricultural commodities, and assist foreign agricultural development.

Need for Increase: The program benefits U.S. agriculture and helps participating countries to further enhance their research capabilities without adverse effect on U.S. balance of payments. The increase of $2,500,000 proposed in FY 1977 would be used to finance research overseas through the purchase of excess foreign currencies. For FY 1977, excess currencies are expected to be available in seven countries--Burma, Guinea, India, Pakistan, Poland, Tunisia, and Arab Republic of Egypt. Based on surveys of the scientific capacity of foreign institutions and evaluation of research proposals submitted by these institutions, the total amount requested for FY 1977 can be effectively used to finance research of a mutual interest.

Anticipated obligations for FY 1976 based on available and negotiated research proposals total approximately $8.0 million. A balance is not anticipated.

At present, there are approximately 99 approved research proposals which cannot be financed with FY 1976 funds, 84 additional proposals are being reviewed or being revised by Department scientists, and based on past experience an additional 100 proposals will be received during the course of 1976. Of those received in 1976, approximately 45 are expected to be approved for research. Leading into FY 1977, we should have over 228 approved proposals awaiting financing of which approximately 75 could be funded within the FY 1977 estimate of $10,000,000.

Overseas research utilizing foreign currencies under Sections 104(b)(1) and (3) of Public Law 480, as amended, supplements and complements research conducted in the United States under regular dollar appropriations. These foreign research projects do not duplicate or displace domestic research conducted by the Department or its cooperators. The projects are of mutual interest to the United States and the host countries.

Plan of Work: The $5 million increase in foreign currencies will be used for new grants to undertake studies aimed at solving high priority agricultural problems such as new and improved uses of cotton; improvement of market quality of exported farm products; improvement of transportation and storage methods; research on cereal grains, legumes and oilseeds; research on pesticide residues; research on improved soil and water use; and research to develop and apply alternative agricultural production systems in narcotic producing areas. Other important program priorities to be continued will be pollution; food safety; nutrition and health; livestock production, protection, and quality, environmental resources; timber production; plant protection; new and improved plant germ plasm; and research to find parasites and predators to control crop pests of economic importance.

STATUS OF THE SPECIAL FOREIGN CURRENCY RESEARCH PROGRAM (SFCRP)

In Fiscal year 1958, the Department initiated a research grant program abroad utilizing foreign currencies from the sale of surplus agricultural commodities under Title I of Public Law 480. Originally confined to market development research authorized by Section 104(b) (1) of P.L. 480, as amended, the program was subsequently expanded to include agricultural and forestry research under Section 104(b) (3) of the law, as amended. In fiscal year 1966, the authorization changed to permit the use of all excess currencies for work performed under the Special Foreign Currency Program. Activities sponsored fall into the following general areas:

1. Agricultural research, including research on plant and animal production; use and improvement of soil, water and air; and research on marketing, use and effects of agricultural products.

2. Forestry research, including research on the protection of forests from fires, diseases and insects; on methods and procedures for increasing the growth of managed forests, and on properties and uses of forest products.

3. Agricultural economics research, including farm and market economics research and foreign trade analysis.

Dollar-financed research in these areas is conducted by the Agricultural Research Service, the Forest Service, and the Economic Research Service in their respective areas of functional and subject-matter responsibilities. Research under this program is designed to complement and not to duplicate or displace the dollar-financed research activities of these agencies.

Within the Department, primary responsibility for administration of this program is assigned to the Agricultural Research Service. The activities are coordinated with operations in the Forest Service, Economic Research Service, and the Foreign Agricultural Service by the Director, International Programs Division, ARS. The Director coordinates development of broad policies for operations of the program and coordinates the activities of the various Department agencies in carrying out research financed by foreign currencies. Initial arrangements and budget clearances for the research in foreign countries are made through the Department of State as required by Executive Order 10900, Section 3(b) and (c), and through the Agricultural Attaches of the Foreign Agricultural Service of the Department.

Prior to executing any research agreement with a foreign institution, the Department again consults with the Agricultural Attaches and Heads of Missions to insure that the proposed projects would be consonant with the foreign policy of the United States.

Care is exercised to make certain that research projects undertaken benefit American agriculture and do not develop undesirable competition for American agricultural products abroad. Careful attention is given to the type of institution conducting research under this program to make certain it has the facilities, equipment, and personnel to carry out sound and productive research. Because of these high standards about 56 percent of the proposals received from foreign institutions have been rejected by the Department; 39 percent of the proposals have been accepted, and these agreements have been executed or are awaiting execution; and final determination has not yet been made on acceptance or rejection of the remaining 5 percent.

Selected Examples of Recent Progress: Through June 30, 1975, a total of 1,606 research agreements have been obligated with foreign research institutions. In fiscal year 1975, 35 new agreements were obligated. Agreements vary in total amount for the life of the project from approximately $12,000 to slightly over $350,000 dollar equivalent. Recent examples of research progress under these agreements follow:

AGRICULTURAL RESEARCH

1. Greenbug Resistance Found in Sorghums. Sorghum germplasm collected in India has contributed a natural resistance to greenbugs in new hybrid sorghums now being produced by U.S. commercial seed companies. The new resistant hybrids are expected to add $8 to 12 million to the yearly income of sorghum farmers. The new hybrids not only will spare farmers the cost of buying and applying insecticides to control greenbugs, but also will reduce the level of insecticides released to the environment. Seed companies expect to have enough seed of the new hybrids available to plant 50 percent of the 1976 sorghum crop. By 1977, the new hybrids will be available in sufficient quantities to plant the entire crop.

2. Resistance of Wheats to Stored-Grain Insects. Wheat varieties collected in India have shown varying degrees of resistance to the rice weevil and the lesser grain borer, two major pests of stored grain. ARS wheat breeders are now trying to transfer this resistance into wheats to be grown in this country. Success will result in greatly reduced losses of wheat in storage. Data obtained to date from ARS experiments in Kansas indicate that two of the imported India varieties developed only about 4 percent insect infestation while comparison varieties developed over 90 percent infestation.

3. Preventing Livestock Losses from Circling Disease. Animal disease research in Yugoslavia showed that poor quality silage can provide a growing media for the bacterial organism that causes listeriosis, or circling disease, in sheep and cattle. The organism thrives in silage when the acidity level is too low. To avoid the problem, the research showed farmers must be sure that silage additives have sufficient acidity and that scraps of waste silage are not allowed to accumulate where animals can get to them. Listeriosis causes abortion and affects the central nervous system. Affected animals often wander in aimless circles, thus the name circling disease. This study provides new information for better silage management techniques and ways of preventing losses from listeriosis in U.S. herds.

4. Better Apple Crops. Biennial bearing of apples is a problem in the United States. Fruit thinning is practiced to try to even out the crop differences from year to year. For some time it has been suspected that it is the seeds, rather than the fruit, which in heavy crop years produce the hormones that depress formation of the new flower buds that will make the succeeding year's crop. This explains the alternating pattern of heavy and light crops. Polish investigators provided detailed information concerning production of the hormone gibberellic acid by the seed. They also clarified the hormonal relationship between the developing seed and the plant, and explained how this relationship controls the biennial cropping phenomenon. USDA scientists are applying this information by spraying anti-hormonal compounds on leaves in minute amounts per acre at times when the seeds are most actively producing and releasing their flower bud inhibiting hormones. This Polish research is opening the way for apple growers to even out and improve their annual cropping patterns and also is being used as a means for inducing trees to produce fruit at a younger age.

5. Fumigation of Foods and Feeds. Israeli scientists demonstrated that fumigant residues do not constitute a health hazard for humans or animals when fumigation is done using regularly recommended procedures. The fumigants studied were: carbon tetrachloride, trichlorethylene, ethylene dichloride, ethylene dibromide and mixtures of these fumigants. Their research results stressed the importance of adequate aeration of foods and feeds, after fumigation with ethylene dibromide and before feeding to breeding bulls and laying hens, to avoid possible effects of chronic poisoning in these animals. The analytical methods developed for the determination of fumigant residues in products and for the assessment of poisoning in animals are highly useful in conducting evaluation of fumigants in U.S. laboratories.

6. New Raspberry Varieties. Breeding trials in Yugoslavia have produced superior varieties of raspberries showing thornlessness, resistance to the aphid vector of virus diseases in North America, and potential resistance to root rot. Fruit color also was studied and determined to be the result of multiple-gene inheritance. The benefit of this research to U.S. agriculture is the additional germplasm added to the U.S. breeding program where it is being used for improvement of domestic raspberry varieties, especially in developing thornless, self-supporting varieties with an extended fruiting season.

7. Greater Efficiency from Dairy Heifers. Animal scientists found in an Israeli study that well-fed dairy heifers reach puberty as young as 6 to 8 months, although the scientists recommend delaying breeding until 11 months. This finding has major implications for U.S. dairy farmers. The common practice in the United States is to delay breeding until dairy heifers are 15 to 17 months old. The Israeli work showed that well-fed heifers can be bred at 11 months with only a small sacrifice of milk yield during the first year of production. During the second and third years, early-bred heifers yield as much milk as older-bred heifers. Over their productive lifetimes, early-bred heifers produce more milk per day of life. In all, the study shows that farmers can realize a greater return from their dairy heifers by feeding at a high nutritional level and breeding them at about 11 months of age.

FORESTRY RESEARCH

8. Biological Control of the Gypsy Moth. An Indian study has identified several new parasites of the gypsy moth--potentially the most serious defoliator of hardwood trees in the Eastern United States. The gypsy moth, a worldwide forest pest native to Europe, Asia, and North Africa, was introduced into the United States from Europe. American scientists previously have imported gypsy moth parasites from Europe, and they are in varying stages of trial at this time. There is now less likelihood of finding additional promising control parasites in that part of the world. On the other hand, the gypsy moth parasites of Asia have not been well explored. U.S. Forest Service entomologists are enthusiastic about the gypsy moth control potential of the parasites identified in the Indian study. The Forest Service has released Indian gypsy moth parasites, representing 8 different genera of insects, and is carefully determining their control potential under U.S. conditions.

Special Foreign Currency Program
Research Proposals and Agreements by Subject Matter
(Cumulative: to June 30, 1975)

	Number of Proposals				Total Number of Agreements Obligated		Total Number of Agreements Currently Active	
	Received	Rejected	Awaiting Modification Negotiation or Review	Approved (Proposals) Awaiting Obligation	Number	Dollar Equivalent	Number	Dollar Equivalent
Agriculture Research Service	3,868	2,237	72	182	1,377	$88,124,048	333	$25,225,110
Forestry Research	493	237	8	29	219	14,066,130	60	5,422,674
Agricultural Economics Research	160	106	7	3	44	2,470,939	14	1,206,308
Statistical Reporting Service	3	2	-	-	1	32,073	-	- 1,467
Animal & Plant Inspection Service	1	-	-	1	-	---	-	---
TOTALS	4,525	2,582	87	215	1,641	$104,693,190	407	$31,852,625

Obligations, Expenditures and Conversions of Foreign Currencies

Obligations: Through June 30, 1975, a total of $110,915,643 (including $4,677,355 for administrative expenses) has been obligated for activities under the Special Foreign Currency Program. In fiscal year 1976, and transitional year, an additional $8,926,000 and 1,850,000, respectively, will be used. These obligations are summarized as follows:

Cumulative Obligations through F.Y. 1976 and Transitional
(dollars in thousands)

Fiscal Year	Market Development Research (sec. 104(b)(1))	Agricultural and Forestry Research (sec. 104(b)(3))	Translation of Publications and Scientific Cooperation, Executive Office of the President a/	Total
1958	$ 371.5	- -	- -	$ 371.5
1959	1,651.8	- -	$ 1.7	1,653.5
1960	2,230.5	- -	793.2	3,023.7
1961	1,893.2	$1,832.4	1,565.2	5,290.8
1962	2,859.0	5,294.6	595.8	8,749.4
1963	2,566.3	5,000.7	248.6	7,815.6
1964	3,214.8	4,466.4	555.5	8,236.7
1965	3,485.8	5,408.1	72.2	8,966.1
1966	703.7	3,877.4	-199.5	4,381.6
1967	1,620.6	7,953.2	114.5	9,688.3
1968	991.9	6,317.0	-44.1	7,264.8
1969	971.9	4,733.2	- -	5,705.1
1970	790.5	4,076.0	- -	4,866.5
1971	654.0	4,171.8	- -	4,825.8
1972	840.4	5,853.6	- -	6,694.0
1973	1,026.1	7,995.8	- -	9,021.9
1974	195.9	7,551.5	- -	7,747.4
1975	349.2	6,263.6	- -	6,612.8
1976 (est'd.).....	1,000.0	7,926.0	- -	8,926.0
Transitional (7/1 - 9/30/76 est'd.)	300.0	1,550.0	- -	1,850.0
Total	$27,717.1	$90,271.3	$3,703.1	$121,691.5

a/ This fund merged with Special Foreign Currency Program by the Department of Agriculture and Related Agencies Appropriation Act, 1969.

The following tables present a more detailed picture of the $6,612,831 obligated in 1975 and the $8,926,000 estimated to be obligated in 1976 and 1,850,000 Transitional for the Special Foreign Currency Program.

Special Foreign Currency Program, FY 1975 Obligations
(In Thousands)

Country	Market Development Research Section 104(b)(1)	Agricultural and Forestry Research Section 104(b)(3)			Total
	Agricultural Research	Agricultural Research	Agricultural Economics Research	Forestry Research	
Austria	$ - .4	- -	- -	- -	$ - .4
Burma	- -	$ .5	- -	- -	.5
Colombia	- -	- .1	- -	- -	- .1
Egypt	- -	2,290.1	- -	$ 69.4	2,359.5
Germany	1.0	- -	- -	- -	1.0
Guinea	- -	.9	- -	- -	.9
India	50.7	530.1	21.1	71.0	672.9
Israel	- 32.9	- 100.3	- 5.9	- 8.1	- 147.2
Italy	50.6	1.9	- -	1.9	54.4
Morocco	- -	20.3	- -	- -	20.3
Pakistan	73.3	1,195.9	206.2	384.9	1,860.3
Poland	216.3	1,231.1	- -	388.3	1,835.7
Sri Lanka	- -	- 4.3	- .7	- .7	- 5.7
Tunisia	- -	116.3	- -	29.0	145.3
Turkey	- -	- 2.6	- -	- -	- 2.6
United Kingdom	- .2	- -	- -	- -	- .2
Yugoslavia	- 9.2	- 137.2	- 2.3	- 33.1	- 181.8
Total	$349.2	$5,142.6	$218.4	$902.6	$6,612.8

NOTE: Negative obligations shown here result from the effect that changes in the rate of exchange have on the dollar value of unliquidated obligations.

Special Foreign Currency Program, Estimated FY 1976 Obligations
(In Thousands)

Country	Market Development Research Section 104(b)(1)	Agricultural and Forestry Research Section 104(b)(3)				
	Agricultural Research	Agricultural Research	APHIS	Agricultural Economics Research	Forestry Research	Total
Burma	- -	$ 1.0	- -	- -	- -	$ 1.0
Egypt	$131.6	1,435.7	- -	$497.7	- -	2,065.0
Germany, West	1.0	- -	- -	- -	- -	1.0
Guinea	- -	100.0	- -	- -	- -	100.0
India	343.0	1,120.9	- -	- -	$194.1	1,658.0
Italy	40.0	2.5	- -	- -	2.5	45.0
Pakistan	300.0	1,170.0	$125.8	- -	413.2	2,009.0
Poland	184.4	1,076.6	- -	- -	385.0	1,646.0
Tunisia	- -	299.4	- -	- -	.6	300.0
Totals	$1,000.0	$5,206.1	$125.8	$497.7	$995.4	$7,825.0
Transfer to National Science Foundation for translation of scientific publications						$1,101.0
GRAND TOTAL						$8,926.0

Expenditures: Expenditures of foreign currencies, from the inception of the program through June 30, 1975, totaled $90,712,349. In addition, the Department plans to expend $8,515,000 in fiscal year 1976 and $2,153,000 in Transitional year. These expenditures may be summarized as follows:

Cumulative Expenditures through F.Y. 1976 and Transitional
(In Thousands)

Fiscal Year	Market Development Research	Agricultural and Forestry Research	Translation of Publications and Scientific Cooperation Executive Office of the President a/	Total
1959	$ 195.1	$ - -	$ 0.1	$ 195.2
1960	654.6	- -	75.1	729.7
1961	1,254.9	350.2	495.2	2,100.3
1962	1,735.8	1,351.8	425.6	3,513.2
1963	2,136.8	2,071.7	590.9	4,799.4
1964	2,292.9	2,514.9	655.5	5,463.3
1965	2,816.3	3,724.6	616.0	7,156.9
1966	2,435.2	4,113.9	211.2	6,760.3
1967	2,487.0	4,754.6	224.7	7,466.3
1968	1,951.0	5,028.8	200.5	7,180.3
1969	1,598.9	5,454.6	- -	7,053.5
1970	1,092.6	4,863.4	- -	5,956.0
1971	955.9	4,753.1	- -	5,709.0
1972	884.2	5,337.3	- -	6,221.5
1973	704.1	4,644.0	- -	5,348.1
1974	731.2	7,052.9	- -	7,784.1
1975	783.6	6,491.7	- -	7,275.3
1976 (est'd.)	766.4	7,748.6	- -	8,515.0
Transitional (7/1 - 9/30/76 est'd.)	194.0	1,959.0	- -	$ 2,153.0
Total	$25,670.5	$72,215.1	$3,494.8	$101,380.4

Cumulative Expenditures through F.Y. 1976 and Transitional (Cont'd.)
(In Thousands)

Conversions: As of June 30, 1975, the Department had converted a total of $4,833,448 of foreign currencies as follows:

Fiscal Year	(Dollars in Thousands)
1961	$ 770.0
1962	1,432.0
1963	1,910.1
1964	721.3
Total	$4,833.4

a/ This fund merged with Special Foreign Currency Program by the Department of Agriculture and Related Agencies Appropriation Act, 1969, are included in the preceeding table.

(c) Working Capital Fund, Agricultural Research Center

This Working Capital Fund has been a continuing operating fund established by the 1951 Agricultural Appropriation Act with an appropriation of $300,000 to finance the operating costs of certain centralized services and facilities at the Agricultural Research Center, Beltsville, Maryland, pending receipt of reimbursements for such costs from the agencies provided with the services. The integrity of the original appropriation has been maintained from year to year by means of these reimbursements.

Effective July 1, 1973, the activities are being carried out and financed under the Agricultural Research Service regular appropriation. Services performed for other agencies are now on a reimbursable basis. The fund was dissolved as of June 30, 1974, and the initial $300 thousand appropriation, returned to the General Fund of the Treasury on June 30, 1975.

Passenger Motor Vehicles

The 1977 Budget Estimate does not include any purchase of additional passenger motor vehicles. A total of 90 vehicles will be replaced.

Replacements

Replacements would be made of 90 of the 470 (including 7 buses) passenger motor vehicles operated at field stations engaged in research. These vehicles are used in travel where no public transportation is available, such as to farms, ranches, cooperating experiment stations, etc., and in travel to remote sections of large stations. They are essential for collecting experimental data and materials necessary for facilitating research work.

It is estimated that all of the 90 passenger vehicles to be replaced will have mileage of more than 60,000 or be 7 or more years old.

Age and Mileage Data for passenger-carrying vehicles on hand as of June 30, 1975:

Age-Year Model	Number of Vehicles */	Percent of Total	Lifetime Mileage (thousands)	Number of Vehicles */	Percent of Total
1965	10	2	80-100	10	2
1966	7	2	60-80	53	12
1967	8	2	40-60	136	32
1968	48	10	20-40	150	29
1969	66	14	Under 20	116	25
1970	74	16		465	100
1971	82	18			
1972	25	5			
1973	89	19			
1974	53	11			
1975	3	1			
Total	465	100			

*/ Excludes 9 vehicles used in foreign countries, and 7 buses.

Aircraft

Replacements

The one replacement plane would be one designed specifically for agricultural work and would be used by technicians in investigating and demonstrating the use of special equipment for suppression of destructive insects attacking crops. Replacements will be made by purchase or from surplus sources. Planes rapidly become obsolete and uneconomical to repair and are subject to many mishaps. Replacement will not be made, however, if it is found practical and economically feasible to retain the present equipment.

Additions

The one additional aircraft requested is urgently needed to maximize the data gathering potential of ARS remote sensing missions in the Southwest. The aircraft would provide photography up to 20,000 feet; this is currently available through NASA on a very restricted basis. Since a minimum of 300 hours of flying time is required annually to fulfill ARS missions, the additional aircraft would result in an estimated annual savings of $18,000 over commercial service. In addition, commercial aircraft often are not available at critical times (10:00 a.m. - 2:00 p.m.) during clear days that are essential for aerial photography. Other advantages of the requested aircraft include increased acreage per photographic frame due to increased altitude capability and faster coverage due to higher ground speeds.

The aircraft would be used for immediate remote sensing studies involving citrus blackfly, imported fire ant, greenbug on sorghum and wheat, pecan pests, and other pests of citrus, vegetables and sugar cane.